TFYP WORKING GROUP Sr. No. 36/2001

REPORT OF
THE WORKING GROUP ON
ENVIRONMENTAL AND OCCUPATIONAL HEALTH
FOR
THE TENTH FIVE YEAR PLAN

GOVERNMENT OF INDIA
PLANNING COMMISSION
AUGUST - 2001

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CHAPTER – 1

INTRODUCTION

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Preamble

The planning commission constituted a working group on environment and health to formulate policy guidelines, strategies and programme objectives during the tenth-five year plan period (2002-2007). As a part of the Working Group, a Sub-group on Environmental and Occupational Health consisting of fifteen Members (annexure 1) was set up with following "Terms of Reference":

1. To assess the quantum of environment related health problems in the country and the projected figures for the 10th Plan Period.
2. To review on-going initiatives by various Departments to prevent environmental deterioration and minimize health hazards associated with environmental deterioration.
3. To assess alternative technologies, strategies to rapidly identify, prevent or minimize environmental deterioration and its health consequences.
4. Programmes for prevention of environmental degradation, prevention, detection and management of related health problems during the 10th Plan.
5. Suggest effective mechanism of inter agency coordination in data collection, collation and convergence in formulation and implementation of intervention programmes.
   - On-going projects, mid-course correction
   - Proposed initiatives
   - Manpower & Financial requirements

The group met on 21st Feb 2001 and 20th March, 2001 at ICMR head quarters, New Delhi. The minutes of these meeting are presented in Annexure 2. A third meeting consisting of Prof. K. J. Nath, Dr. P. K. Seth, Dr. H. N. Saiyed, Dr. S. K. Bhattacharya, Dr. D. J. Parikh and Dr. A. Dewan met at National Institute of Occupational Health, Ahmedabad on 30-4-2001 to discuss on the draft document. During these meeting certain resource

persons were identified. This document is the outcome of the contributions of individuals, discussions and editing by the scientists of NIOH.

Background Information

Environmental quality is an important determinant of human health. Deteriorating environmental conditions are major contributory factors to poor health and poor quality of life, and hinder sustainable development. The degree of economic development determines the type of environmental health hazards. Countries with least economic development are most at risk from traditional environmental health hazards which include lack of water supply and sanitation, poor housing and shelter, unsafe food and high prevalence of disease vectors. Indian economy is in a state of transition and under these conditions, the population is at risk both from the "traditional" environmental health hazards and from the "modern" hazards such as air and water pollution, hazardous waste, unsafe use of chemicals including pesticides, workplace hazards and traffic accidents.

Scope of the term "Environment"

In the modern concept, environment includes physical, biological and social components.

i) Physical: Air, water, soil, housing, wastes, radiation etc.

ii) Biological: Plant and animal life including bacteria, viruses, insects, rodents and animals

iii) Social: Customs, culture, habits, income, occupation, religion etc

Behavioural or life style factors though extremely important for human health cannot be included, as the most effective interventions for mitigation tend to be somewhat different from those for more conventional environmental factors such as pollution. Some social factors such as crime, stress and war and the natural factors such as earthquakes and inclement weather are sometimes not included on the basis of unstated presumption that environmental health deals only with those aspects of environment that are affected measurably by human activities and not those due to nature in raw.

Definition of Health

According to WHO(1948), " Health is a state of complete physical, mental and social well being and not merely an absence of disease or infirmity". This definition has been criticized for being too broad. In a narrow sense – health means that " there is no obvious evidence of disease, and that a person is functioning normally, within normal limits of variation".

Environmental Degradation

Some of the key factors associated with environmental degradation are :

- Population and Poverty
- Urbanization and Industrialization

A complex relationship exists between population growth, environment and health. Increase in population leads to intensified human activities, which in turn lead to resource depletion and environmental damage. According to 2001 census Indian population has already crossed the one billion mark. Such a high population growth combined with inequitable resource distribution is a major contributing factor to the increase in poverty which itself is a source of much suffering and ill health.

World-wide, cities are growing fast and the world population living in urban areas has grown from 38% in 1975 to 45% in 1995. In India, the urban population in 1951 was 17.3%, in 1991 it reached to 25.7% and at present is estimated to be more than 30%. In the absence of good public transport, the number of vehicles has increased exponentially, leading to deteriorating environmental conditions in all major cities of the country. Due to limited resources and lack of infrastructure facilities, large percentage of urban population are forced to live in slums and shanty towns without basic amenities like safe drinking water, sanitation and sewage disposal.

Another rapid development taking place in India is the growth of industries specially in the small scale and unorganized sectors. Industrialization is central to the development but in the absence of appropriate technology and environmental safeguards, industry becomes a major source of air and water pollution, hazardous waste and noise.

Industrial operations can have significant environmental impacts which may jeopardize the health of work force and nearby populations.

Some important factors related to environmental degradation are narrated below:

ENVIRONMENT AND DISEASE BURDEN: Environment and disease burden are often believed to be closely associated with each other. The burden of disease is defined as the probable number of person suffering from a given disease at a given point of time/period of time. The knowledge of disease burden helps administrators/planners/policy makers to initiate appropriate action programmes for the management and control of the diseases. Its knowledge also helps in effective utilisation of available manpower and financial resources.

On a per-capita basis as compared to the other seven major world regions, India bears the second largest burden of total ill-health. The average Indian loses about 124 days of healthy life per year, second only to sub-Saharan Africa, which loses about 211 days per capita per year. The main causes of disease are similar for these two regions, with some exceptions. For example, tuberculosis is relatively more important in India whereas malaria is more important in sub-Saharan Africa. In addition to the total burden per capita, the proportion of ill-health due to environmental factors generally seems to decrease with economic development.

Some diseases like measles, polio, tetanus and other important infectious diseases have significant environmental components, still, a high proportion of their risk cannot be attributed to environment because effective vaccines are available now. Nevertheless, for other such environmentally infectious diseases that do not currently have effective vaccines (for example diarrhoeal diseases, malaria etc.), a high proportion of risk can be reduced by the modulating environmental factors. It is interesting to consider as to what fraction of the disease burden can be averted first through feasible and timely environmental interventions, before other interventions are applied. For example, it is well recognised that ARI burden can be substantially reduced through better nutrition but the beneficial effects of the environmental improvement, i.e. controlling indoor air pollution arising from the domestic

fuels, tobacco smoke and ambient air pollution, remains to be studied.

Many of the major ill health conditions are closely associated with their surrounding environmental conditions. Table 1 depicts potential relationship between exposure situations and health conditions. Contamination of air, water and food are the principal sources of environmental health hazards. In addition, manner of handling household wastes and sewage, the environmental conditions in which people live and work and soil quality are other important determinants of environmental health impacts.

Table 2 shows proportion of disability-adjusted lost life years (DALYs) associated with environmental exposures. DALYs is a recently developed concept which incorporates the lost years of life due to morbidity (disability) as well as mortality. DALY, like any other estimate of burden of disease is an approximate estimation due to incompleteness of data and lack of agreement on measurement criteria. Nevertheless, at present it is considered as the best estimate of the burden of disease. The percentages shown in the table reflect how much environmental control can contribute to the reduction of the disease. Thus even though many diseases (diarrhoeal diseases, malaria, measles, polio and tetanus) might be arguably 100% environmental, a lesser percentage is indicated because of the availability of the alternate effective preventive and curative measures including vaccination. However, for environmentally-mediated infectious diseases (e.g. ARI, for which effective vaccine is not available.

The National burden of diseases (NBD) is shown in table 3. The list includes only those disease categories causing at least 1% of the NBD or at least 1% of all deaths. Here the NBD is shown as premature deaths and lost disability-adjusted life years (DALYs), as is becoming common in international comparisons. This basically indicates the amount of healthy life years (based on life expectancy) lost because of a disease, including both mortality and morbidity.

Acute Respiratory Infections (ARI)

One of the major diseases thought to be associated with polluted air and unhealthy housing conditions is Acute Respiratory Infections (ARI). Out of 116

million DALYs lost , globally, due to ARI , 60% of it can be attributed to environment alone. Further, out of all DALYs lost, for all ages due to all diseases, about 5% lost is contributed by ARI. In every country, young children contract these diseases at similar rates, but in India and other poor countries they often proceed to severe stages, including pneumonia and death. ARI is the largest single disease category for India, accounting for about one-eighth of the national burden. For the world as a whole, ARI is also the largest category, accounting for about 8.5% of the global burden. Indian ARI is actually the largest single disease category in the world, in the sense of being subject to attention by one government. The Indian portion of this one disease class, which affects mainly one age group, accounts for 2.5% of the entire global burden of ill-health.

Diarrhoeal diseases

Globally, about 99.6 million DALYs lost are attributed to diarrhoeal diseases and about 90% of them can be prevented by proper management of the environmental factors such as excreta and household waste, polluted water and polluted food. In India, out of all DALYs lost, it is estimated that 10% are contributed by diarrhoeal diseases.

Malaria

Globally, about 31.7 million DALYs lost are attributed to malaria and proper management of the environmental factors can prevent about 90% of them. The important environmental factors known to influence malaria are household waste, polluted water and unhealthy housing.

Cancer

Based on the application of incidence rate of cancer from the population-based cancer registries of ICMR, to the entire country, the projected number of new cases was 7.9 lakh and there were 24.5 lakh cases of cancer in India in 2000. The oral, lung, cervix, breast, oesophagus and liver are the major sites of cancer in India. Environmental factors such as tobacco smoke, occupational exposures, radiation, air pollutants, radiation, viral infections and radiation are few of the leading environmental risk factors held responsible for about 80 to 90% of the cases of human cancer. However, environmental

control measures can reduce about 25% of the disease burden. Generally, several factors are responsible for cancer. For example, it is not possible to tell whether a particular case of lung cancer was caused by smoking, air pollution, inherited genes or some other factor. Nevertheless, using a combination of research, scientists have been able to estimate the potential importance of various risk factors.

Epidemiological studies have shown a strong relationship between specific occupational exposures and certain type of cancers. Exposures to asbestos, arsenic, benzene, certain synthetic organic dyes, nickel, chromium are few of the well known carcinogenic substances. The most telling evidence that controllable (non-genetic) factors play an important role is that cancer rates are quite different in different parts of the world, and when peopie move from one region to another they gradually take on the cancer pattern of new location.

Chronic Obstructive Pulmonary Diseases (COPD)

Respiratory system is the portal of entry and therefore the preeminent victim of the damage caused by the air pollutants originating from the vehicles, industrial activities or domestic activities. The susceptibility of the lungs to the air pollutants is beginning to be realised only recently. Epidemiological studies completed in the past ten years in the USA and Europe have consistently demonstrated that excess respiratory morbidity occurs at much lower levels of ambient urban air pollution than was previously realized. NIOH studies amongst traffic policemen and the shopkeepers showed significantly higher prevalence of chronic respiratory symptoms. Several study reports from India and other developing nations have clearly established link between COPD in women and use of biomass fuels.

Cardiovascular Diseases

Cardiovascular diseases (CVD) tops the list of global deaths. The estimated DALYs lost due to these diseases is around 13.3 million years and 10% lost out of it could be attributed to environmental conditions. CVD consist of coronary heart disease (CHD) and other diseases of heart and valves. The risk factors are divided into four major categories namely, non-modifiable

(genetic) risk factors, modifiable physiological (hypertension, high cholesterol etc.) risk factors, behavioral (smoking, diet) risk factors and environmental risk factors. The environmental risk factors include outdoor and indoor air pollution, exposure to lead and arsenic.

In India, about 27% of DALYs lost and about 30% of the deaths can be attributed to the environmental related diseases.

Occupational Diseases and Injuries

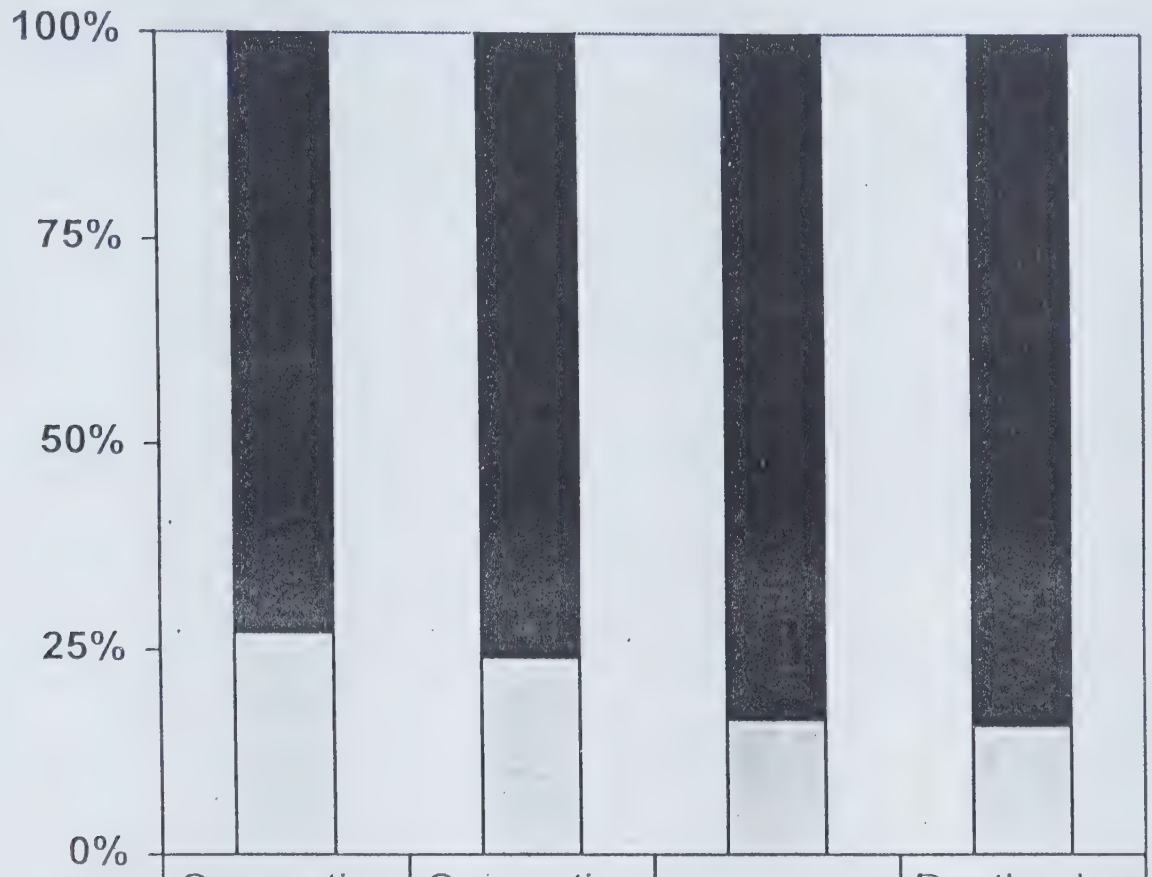
Occupational factors make an important contribution to the global burden of disease. In addition to the misery of the worker and his/her family, morbidity and mortality results into economic burden to the society through decreased production from decreased efficiency, sickness absenteeism, higher labour turnover and loss of skilled manpower and cost of medical care. The estimated cost to the society in various studies in different parts of the world varied from 2 – 15% *(Mikheev M. New epidemics : The challenges for international health work. In: New Epidemics in occupational health, Finnish Institute of Occupational Health, 1994; 27 –33.)*. A recent study by WHO *(Leigh J, Macaskill P, Kuosma E and Mandryk J Global burden of disease and injuriy due to occupational factors. Epidemiology 1999; 10:626 – 631.)*

It is estimated that approximately 100 million occupational injuries (1 lakh deaths) and 11 million occupational diseases resulting in 7 lakh deaths occur in the world each year. The report further states that, in India each year there are 17 million non fatal and 45,000 fatal occupational injuries. Further analysis of the data show that about 37% of the occupational injuries in the world and 32% deaths due to these injuries occur in India. (Figure 3).

Occupational Injuries and Diseases in India and Rest of the World

The WHO estimate also show that each year 924,000 to 1,902,300 cases of occupational disease occur of which 121,000 die during the year. Taking an average of the range, show that about 17% of the occupational diseases occurring in the world and 18% of the deaths due to occupational diseases, take place in India. The investigators claim these estimates as most conservative. These figures for occupational injuries and occupational

diseases are highest for any single country and surpasses even China having much larger work force.



	Occupational Injuries (Non Fatal)	Occupational Injuries (Fatal)	Occupational Diseases	Deaths due to Occupation
■ Rest of the World	45696000	141813	7125750	643950
□ India	17000000	45000	1413500	121000

Figure 3. Comparison of Annual Incidence of

Studies carried out by NIOH supports the above estimates for occupational diseases. For example the retrospective analysis of the data from four textile mills in Ahmedabad employing on average 1000 workers by NIOH *(Annual Report 1999-2000, National Institute of Occupational Health, Ahmedabad)* for occupational injuries for a period of two years revealed 3592 reported cases of non fatal injuries (necessitating two or more days away from work) i.e. an annual incidence of 449 cases/1000 workers/year. There are 1 million textile workers and therefore the total number of injuries in textile mill alone will be 449,000 cases. These reported cases do not include injuries not necessitating absence from the work for 2 or more days.

From the above discussion, it is obvious that population growth and poverty are two major factors responsible for the environmental degradation leading to the occurrence of "traditional" environmental diseases like water borne diseases, malnutrition and vector borne diseases. Rapid industrialization is the only solution to solve our poverty related problems but the same can add to "newer" problems due to pollution of air, water and soil pollution. Economic growth, industrialization environment and health are closely linked. And therefore in solving these problems a unified approach involving multi-sectoral strategy is needed.

Table 1. Potential relationships between exposure situations and health conditions.

Health conditions of concern	***Exposure situations***					
	Polluted air	Excreta and household wastes	Polluted water or deficiencies in water management	Polluted food	Unhealthy housing	Global environmental change
Acute respiratory infections	√				√	
Diarrhoeal diseases		√	√	√		√
Other infections		√	√	√	√	
Malaria and other vector-borne diseases		√	√		√	√
Injuries and poisonings	√		√	√	√	√
Mental health conditions					√	
Cardiovascular diseases	√					√
Cancer	√			√		√
Chronic respiratory diseases	√					√

Source: World Health Organization (1997). Health and Environment in Sustainable Development Five Years after the Earth Summit, WHO, Geneva.

Table 2 Proportion of global DALYs associated with environmental exposures - 1990

	Global DALYs (thousands)	Environmental Fraction (%)	Environmental DALYs (thousands)	% of all DALYs (All age groups)	% of all DALYs (Age 0-14 years)
Acute respiratory infections	116 696	60	70 017	5	4.5
Diarrhoeal diseases	99 633	90	89 670	6.5	6.1
Vaccine-preventable infections	71 173	10	7 117	0.5	0.49
Tuberculosis	38 426	10	3 843	0.3	0.04
Malaria	31 706	90	28 535	2.1	1.8
Injuries	152 188	30	45 656	3.3	1.6
Unintentional	56 459	N.E.	N.E.		
Intentional					
Mental health	144 950	10	14 495	1.1	0.08
Cardiovascular diseases	133 236	10	13 324	1	0.12
Cancer	70 513	25	17 628	1.3	0.11
Chronic respiratory diseases	60 370	50	30.185	2.2	0.57
Total other diseases	975 350	33	320 470	23	15.4
Other diseases	403 888	N.E.	N.E.		
Total all diseases	1379 238	(23)	(320 470)		

N.E. = Not Estimated.

Source: Murray CJL & Lopez AD, eds. (1996) The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Published by Harvard School of Public Health on behalf of WHO and the World Bank. Cambridge, Massachussets, Harvard University Press.

Table 3. Indian National Burden of Disease: Disease categories accounting for at least 1% of lost DALYs or 1% of deaths. Also showing percent of burden in children under 5 and overall female/male ratio. (Modified from Murray C, Lopez A (1996) Global Burden of Disease. Cambridge: Harvard University Press.)

Disease Category	DALYs	Deaths	DALYs in < 5 yr olds [a]	Female/Male [b]
ENVIRONMENT RELATED DISEASES.				
ARI	12	13	80	1.13
Cancer	2.5	5.3	2.7	1.15
COPD	1	1.5	5.9	0.79
Diarrhea	10	9.8	85	1.1
Vector Borne Diseases	1.1	0.4	5.5	0.45
OTHER DISEASES (NOT SIGNIFICANTLY ENVIRONMENT RELATED)				
Falls	3.5	0.5	39	0.62
Heart (ischaemic)	3.5	13	~0	0.81
Perinatal	8.8	7.0	100	1.04
TB	4.6	8.0	6.5	0.58
Malnutrition (direct)	4.2	1.3	52	1.2
Depression	3.6	0.02	0	1.49
Congenital	2.9	1.8	90	1.02
Maternal	2.6	1.2	0	Xxx
Road Accidents	2.1	1.9	14	0.4
Fires*	1.9	1.3	14	2.54
STD/HIV	1.9	0.7	19	1.87
Stroke	1.5	4.8	5.3	0.99
Eye*	1.1	~0	0.3	1.03
Cirrhosis*	1	1.6	4.7	0.46
Suicide	1	1.1	0	0.99
Diabetes*	0.8	1.1	6.2	1.05

ARI= Acute Respiratory Infections; Child Cluster= Measles, Tetanus, Pertussis, Polio, Diphtheria; COPD= Chronic Obstructive Pulmonary Disease; DALY= Disability-Adjusted Life Year; STD Sexually Transmitted Diseases; Tropical Cluster= Vector Borne Diseases. *Not on the global list of 1% diseases. On the global list, but not on India's, are malaria, war, violence, alcohol (direct effects), and drowning. a. Children under 5 are 14% of the national population. b. Ratio of DALYs lost at all ges. c. For total national burden.

CHAPTER – 2

9TH PLAN DOCUMENT

2. 9th PLAN DOCUMENT (MET & UNMET GOALS)

2.1 INTRODUCTION:

During the last five years, there has been some improvement in protection and promotion of environmental health. The Govt. of India has taken several steps in this direction. People also are now aware of some of the problems environment can induce. However, much more could be done had there been co-ordinated inter ministerial effort. In recent years, strong public opinions spearheaded by committed and aggressive NGOs has made the enforcement agencies more active. Frequent intervention and directives from the Judiciaries, resulting out of Public Interest Litigation have also made the government agencies more active and vigilant. Several environmental acts have been implemented during the last decade for the protection of the environment. But enforcement has not been properly made.

Programme components as recommended for implementation under 9th five-year plan has remained largely unattended. It could be seen that action point of many of the recommendations were in the non-health sectors like Ministry of Urban Development, Ministry of Rural Development, Ministry of Environment & Forests etc. It is hoped that the working groups formed for the 10th five year plan in those Ministries would consider the unmet needs as stipulated by the 9th plan working group for the Ministry of Health and Family Welfare while formulating their 10th plan recommendations.

The following were the recommendations made in the planning commission (9th plan) on issues related to environmental health management.

2.2. RECOMMENDATIONS

1. The 9th plan sub-group on environment and health under the Chairmanship of Union Health Secretary strongly endorsed the implementation of Dayal Committee Report (1995) and launching of a

national mission on environmental health and sanitation during the 9th plan with appropriate prioritization of the activities.

2. Sensitizing the Panchayats and Nagar Palikas for planning and implementation of environmental health activities in the context of the historic 73rd and 74th Constitutional Amendments Acts (1992).

3. Enactment of a comprehensive legislation on environment and health.

   It was recommended to constitute a joint inter-ministerial working group comprising the Ministries of Environment and Forests, Health and Family Welfare, Urban Affairs and Employment, Rural Development, Surface Transport to examine the existing environmental acts and provision of model public health bill (revised 1978) and recommend a comprehensive environment and health bill for consideration of the Government.

4. Environmental Standards and Regulations

   a) It was recommended that all environmental studies and regulations related to industrial and agricultural effluents, waste water, solid, hazardous and hospital waste, fuel for industry and motor vehicles, air and noise pollution control need to be reviewed from the point of view of health protection and availability of control technology and appropriate revisions/modifications incorporated.

   b) Fiscal incentives and legislative support for cleaner technology, minimization of waste, reduction of number of vehicles, de-registration of old vehicles and decentralization of industries, etc.

   c) Programme to generate community awareness in environmental health issues and ensure people's participation.

5. Creation of an adequate database linking environment and health

a) Establishing linkage between the data on environmental quality from the environmental sectors and community health status from the health sector supported by primary data from environmental epidemiological studies. It was recommended that during the 9th plan, environmental epidemiological studies should be taken up in 23 critically polluted areas of the country.

b) Further strengthening of existing environmental monitoring programme and health surveillance system in the country and establishing institutional arrangements for monitoring and information management.

c) Interaction on workplace environment and related health problem available with Factory Insspectorates, ESI and general health services should be collated and analyzed and regularly reported to assess work environment related problems and plan intervention programmes.

6. Urban water supply

a) Ministry of Urban Affairs and Employment, Govt. of India to draw programme during the 9th plan to cover all the unserved population with priority for the unserved and under-served weaker sections of the community living in slums and peri-urban areas.

b) ***Urban water quality monitoring and surveillance***: Capacity building in all class-1 towns for necessary manpower and equipment for regular monitoring and surveillance of drinking water quality.

c) ***Low cost sanitation in urban areas***: The programme for liberation of scavengers and conversion of all remaining dry latrines into water seal two pit pour flush latrines is to be completed during the 9th plan.

d) ***Urban sewerage and drainage***: During the 9th plan, sewerage and drainage systems alongwith sewage treatment facilities should be provided on a priority basis in cities and towns growing at a rate more than the national average.

e) ***Urban solid waste management***: Implementation of the major components of the national action plan as envisaged by the high powered committee of the Planning Commission.

7. Hospital waste management

a) Each state should formulate state level plan of action for hospital waste management and include this as a part of state plan.

b) Segregation of infectious wastes at source, their separate collection and safe disposal should be organized by the hospital and municipal authorities. During the 9th plan, necessary legislative support should be framed and capacity building and training of hospital/municipal staff should be undertaken.

8. Hazardous waste management

Creation of a network of regional centers which could take up research and development studies related to safe management of hazardous and industrial toxic waste and assess health and environmental impacts of existing procedures for disposal of the same and undertake pilot studies of economically viable procedures for safe disposal.

9. Environmental sanitation in rural areas

   a) Ministry of Rural Development, Govt. of India should take up Nation wide programme of awareness and demand generation by involving national institutes, universities, village level educational institutes, NGOs and panchayats. Hygiene education should be promoted by ICDS workers and primary health care delivery systems.

   b) Action plan should be undertaken to provide sanitation facilities to about 33 million households in the rural areas through actively involving people and the NGOs. The programme should be carried out with appropriate amount of subsidy, loan and beneficiary participation.

10. Rural water quality surveillance

Ministry of Health and Family Welfare, Govt. of India to initiate action for implementing pilot project in various states to examine the feasibility of AIIH&PH model of community based water quality surveillance and develop a national action plan.

11. Strengthening environmental health systems and support services in Ministry of Health & Family Welfare, Govt. of India

The Directorate General of Health Services in the Department of Health, Govt. of India should be strengthened by establishing a division of environmental health and sanitation and by strengthening the National Institute of Communicable Diseases, Delhi and the All India Institute of Hygiene and Public Health, Kolkata to ensure proper attention to current and emerging issues on environmental health and sanitation including assistance to the Government of India in framing policy and operational guidelines for implementation of the mission objectives related to health surveillance through provincial and local health agencies in collaboration with other nodal ministries.

2.3. MET AND UNMET GOALS / ACHIEVEMENTS

Herein we would specifically discuss those unmet targets which were to be implemented by the Ministry of Health and Family Welfare.

1) Implementation of Dayal Committee Recommendations

The recommendations of the Dayal Committee particularly respect of launching of a National Mission of Environmental Health and Sanitation during 9th Five Year Plan and constitution of an empowered committee under the Chairmanship of Cabinet Secretary for overview, integration and formulation of strategy and specific programmes to fill critical gaps in various activities in the environmental health and sanitation, remain largely non-operative.

2) Sensitization for Panchayat and Nagar Palikas for Planning and Implementation

Through some work has been done by non-health sectors no comprehensive programme has been taken by Ministry of Health and Family Welfare towards the objective.

3) Legislation on Environmental Health

The Joint Inter-ministerial Working Group as suggested by the 9th plan working group to review the existing environment acts and public health bill (1978) and recommending a comprehensive environment and health protection bill was not constituted.

CHAPTER – 3

EMERGING ISSUES IN ENVIRONMENTAL AND OCCUPATIONAL HEALTH

4) Regulation and Standards

Though significant actions were taken from the Ministry of Environment and Forests, involvement of the Ministry of Health and Family Welfare was inadequate.

5) Creation of Database Linking Environment and Health

No comprehensive action programme has taken by the Ministry of Health and Family Welfare to coordinate with the activities undertaken by the Ministry of Environment and Forest in this regard.

6) Urban Water Quality Monitoring and Surveillance

No initiative taken by the Ministry of Health and Family Welfare, not to talk of any comprehensive action plan.

7) Hospital Solid Waste Management

Various recommendation of the Central Council of Health 1996 as endorsed by the 9th Plan Working Group for Hospital Solid Waste Management remained largely un-implemented though the Ministry of Environment and Forest has enacted comprehensive legislation and regulation. For the management of hospital waste activities undertaken by the health sector at the state government as well as central level for training and capacity building had been inadequate.

8) Hazardous waste management

The specific recommendations for creating four centers for excellencies at the AIIH&PH, NEERI, NIOH and IITRC has not been implemented (Action point ICMR).

9) Rural Water Quality Surveillance

The programme started promisingly and in the 1st two years, pilot projec was implemented in the states of Kerala, Karnatakam U.P., Gujarat Haryana, Rajasthan but in the subsequent years very little was done t sustain the programme because of lack of administrative support an bureaucratic hurdle.

During 1999/2000 programme was not implemented in any state.

10) Strengthening environmental health surveillance and support in th Ministry of Health & Family Welfare.

Very little has been done for implementation of this very cruc recommendation of establishing a division of Environmental Health a Sanitation and strengthening NICED, Delhi and AIIH&PH, Calcutta.

2.4. Conclusion

In every five-year plan, a large number of recommendations are made for protection of environment and its impact on health. However, most of recommendations are not fulfilled due to reasons given above. It is ho that from the beginning of 10th five-year plan, serious attention would given to implement the recommendations. It is also hoped that lea experts, planners and administrators of this working group would monitc progress made in achieving goals on environment and health.

EMERGING ISSUES IN ENVIRONMENTAL & OCCUPATIONAL HEALTH[1]

3.1 Environment and Health

3.1.1. URBANIZATION*

Problem Identification

Cities generate a large part of a nation's economic activity, offer employment opportunities, and provide entertainment and other amenities. They also create potential efficiencies not found elsewhere, as well as advantages in the delivery of education, health and other social services. In addition to instigating major land use changes for housing, roads and industry, cities consume large quantities of nation's natural resources. Moreover, given their concentration of people and activities, and their greater levels of consumption, they produce considerable waste and pollution. And as they grow, they increasingly rely on food and other resources obtained from more distant parts of the country. Urban growth also means greater dependence on transport systems, generating further pollution and risk of accidents. The resultant public health challenges are daunting, but with appropriate policies and action programmes, health in cities can be improved.

Identification of priority issues of health in urban areas

Human health and living standards in urban areas are directly influenced by following factors: a) Housing, availability of safe and adequate water supply, safe disposal of excreta and waste, literacy rate, availability of health facilities, density of population, efficiency of law and order system, traffic, etc. Some of the factors should be taken on priority basis. They are as follows:

- Population explosion
- Poor Urban Health Services particularly in slums and deprived areas

[1] Dr. Jugal Kishore, Asstt. Prof., Community Medicine, MAMC, New Delhi.
Prof. S.D. Sharma, Inst. Of Human Behaviour and Allied Sciences, Delhi.

- Traffic injuries
- Water scarcity and polluted water leading to diseases. Illiteracy is one of the most vital forces to bring backwardness, mortality, morbidity and high fertility.
- Housing poverty
- Excreta disposal
- Industrial discharge
- Solid waste and Biomedical Waste Management
- Climate changes: urban environmental pollution
- Mental health & Crime, violence, riots
- Lack of data on health related problems in different degree of urbanization
- Poor inter-sectoral and multidiscipline management
- IEC on health related problems in urban.

Available Database

- **Population explosion and Mega cities**

The number of persons living in urban areas increased globally from 32% of world population in 1955 to 38% in 1975, and to 45% in 1995. It is expected to reach 54% by 2015 (World Health report 1998). In India the urban population in 1951 was 17.3% only however, in 1991 it reached to 25.7% and now it is estimated to be more than 30% (Figure 1).

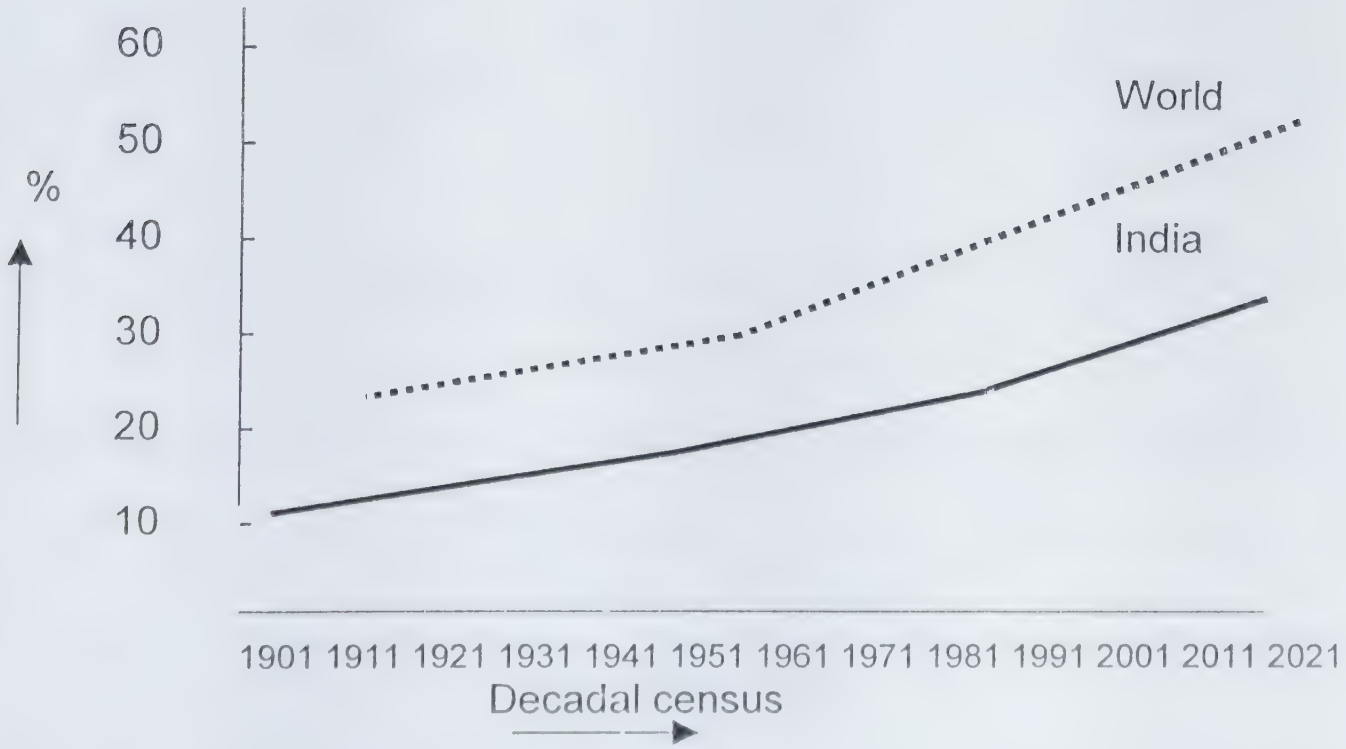


Figure 1. Actual and Projected Population in urban area in India and world (in proportion)

There are 17 cities in developing world, which are considered mega cities, with more than 10 million people. This explosive growth of densely populated cities with unsafe water, poor sanitation, and widespread poverty has established an ideal breeding ground for infectious diseases, according to WHO. It is difficult and expensive to supply clean water and adequate sanitation to 10-20 million people living in a concentrated area, as it requires enormous investments in sewer construction, treatment plants, and personnel not only by government but also by private bodies, NGOs, and people themselves.

- **Comparative status of Indian urban and rural area**

Parameters	Urban	Rural
Crude Birth Rate	20.9	26.2
Crude Death Rate	07.8	10.4
Infant Mortality Rate	49.2	79.2
Total Fertility Rate	02.3	03.1
Piped drinking water	74.5	25.0
Sanitation facilities (Flush Latrine)	63.9	08.8
Availability of Electricity	91.3	48.1
Standards of Living Index (% Low)	14.3	44.7
Children Vaccinated (12-23 months)	61.0	37.0
Women with any anemia (%)	45.7	53.9
Children (6-35mon) with any anemia (%)	78.8	75.3
Underweight children	38.4	49.6
Having Tuberculosis/1000 population	03.9	06.0
Proportion below Poverty line	23.6	27.1

Reference: National Family Health Survey II (1998-1999), National Sample Survey Organization 2000

- **Unplanned urbanization and Poverty**

Unplanned urbanization causes overcrowding in some areas that leads to greater competition, intolerance, and reduction in task performance; individuals residing in high density areas have been observed to experience greater crowding, and to perceive the interpersonal climate as less supportive, and to exhibit more adjustment problems. Further, crowding has been

reported to have negative efforts such as deterioration in the performance of complex task.

In urban areas the population "below poverty line" is 26.1% (NSSO, 1999-2000) came down from 32.4% (1993-94) in a decade. Mostly such population is living in resettlement clusters and slums. Standard of living indices are low and medium in 14.3% and 45.2% of the urban households (NFHS II 1998-99). However, they are much better than rural areas. Urban growth has been driven more by the pull of industrialization and economic opportunity.

Central and state Government failed to plan accommodation for migrated rural poor, thus resulting in clustering of unplanned clusters of slums. Overcrowding, poor housing, civics facilities, etc characterize these slum and resettlement colonies.

- **National Housing and Habitat Policy 1998**

By 1997 the total housing shortages in the country was estimated to be 13.66 million units, out of which 7.57 million units would be in the urban areas. More than 90% of this shortage is for the poor and the low-income category. It was further estimated that Rs. 2,50,000 crores shall be required for urban infrastructure during the Ninth Plan, but not more than 10% would be available from Government sources. Therefore massive participation of the private sector is needed.

The Government through a National Agenda declared HOUSING FOR ALL as a priority area and has set a target of construction of 2 million houses every year with emphasis on the poor and deprived, out of which 0.7 million houses shall be constructed in the urban areas.

The New National Housing and Habitat Policy (NHHP) was formulated in 1998. The Housing and Habitat Policy 1998 mainly aimed to create surplus cost effective housing with liberal legal, financial and administrative support, using modern technology especially for the vulnerable groups and the poor. It

is also advocating empowering the Panchayat Raj institutions and village cooperatives to mobilize credit for adding to the housing stock. *However, not much emphasis is given on quality of housing suitable for health of people and environment.*

- **Natural and social disasters**

Natural and social disasters due to violence, poverty, fire and human error are also very common in urban areas and need to be tackled appropriately. Impact of natural calamities like *earthquakes and flood* is more sever in urban areas where housing construction is not according to standards. We have to learn things for health and safety of workers, and community at large from Bhopal gas tragedy, Latur (Maharashtra) and Bhuj (Gujarat) earthquakes, and super cyclones in Orissa.

- **Road Traffic Injuries**

Dangerous roads and heterogenous traffics in urban areas are common. There is an injury every second and fatality on road every minutes in India. It is the seventh leading causes of death. Road traffic injuries are the most common and mainly confined to urban areas. Available information and technology in developed world may be transferred to expedite the measures of traffic injury prevention and control.

Mental health problems

Mental illness was included as one of the disability under the "Persons with disabilities" (Equal opportunities, Protection of rights and full participation) act of 1995 which came into force on 7th Feb. 1996. The urban poor are at the interface between the under-development and industrialization and their disease pattern reflects the problems of both. From the first, they inherit a heavy burden of communicable diseases and malnutrition while the second brings them its typical spectrum and chronic social diseases including

violence, drug abuse, suicide, depression, anxiety and other mental distresses. Due to this in the urban population, the most vulnerable groups are women, children and old people who will suffer the most.

Today's environment provides physical and psychological stresses that may cause many physical and mental diseases depending on individual and group susceptibility. The urbanization is also associated with *mental disorder* and conduct problems. Health delivery facilities, occupational health centres, and schools must include the component of stress management. Intravenous and addictive drug use is linked with *anxiety, depression* and dissatisfaction in day today life. It is also associated with HIV transmission. There is growing *risk behaviour* in urban adolescents due to exposure to television. There is a need to inculcate healthy life style and living in children particularly in urban areas, where more street children, working children, destitute and sex workers are found.

In the elderly, the dislocation and disturbance from the traditional family support system are increasing psychiatric morbidity including suicides and other negative health consequences which were not seen earlier and were much less in the agriculture based rural sector. In children, the increasing number of the mental health problems including violence, drug abuse and alcoholism and the number of street children, which are rising in our country, need the special focus. The social distress and powerlessness resulting from low level of education and economic dependencies are more glaring in case of women. Further, repeated exposures to entertainment violence in all its forms have significant public health implications.

Educational Programme

- ***Medical & Nursing Education***: Health personnel must be trained in urban problems mainly related to environment and human health through workshops, training courses, conferences, and medical education

curriculum. This will help health care workers to be equipped in the community to give leadership.

- ***Environmental Health Education at the school level:*** Changing curriculum involving government and private bodies may be beneficial. Promotion of health education among people will enable them to come out from their narrow vision of conventional practices and thinking about environment and health. Proper disposal of solid waste, avoid littering the roads, keeping the surroundings clean, planting seedlings, avoiding burning wastes including used rubbers and plastics in the public places, avoiding spitting on the public roads and in the public places, using dust bins to deposit the used papers and used packaging materials are all good practices which people can easily practice as part of improving sanitation strategies. We have many examples of clean cities for our guidance.

- ***Family Education:*** Family environment is also paramount important for the healthy development. "Healthy mind in a happy family" is essential component of safe and healthy cities. Happy society can be assessed on the basis of some indicators for example, level of unemployment, level of disability, disease, and mental retardation, level of drug addiction, and alcoholism, level of marital discords, level of overcrowding, etc.

- ***Primary Education to all children:*** It is already established that educated parents are better manger of health problems in urban environment. More proportion of funds should be allocated to these activities.

Legislation

There are so many provisions in the constitutions of India and the Supreme Court rulings are to safeguard the health of human being and environment. Environment (Protection) Act 1986 and various other rules, National Environmental Tribunal Act, 1995, Motor Vehicle Act 1988, Town and Country Planning Act, Municipal Corporation Acts of various states, which are very

essential for safe and healthy city programme have come into force. The Constitutional Act, 1992 also known as the Nagarpalika Act, the landmark legislation provides a common framework for the structure and mandate of Urban Local Bodies for effective democratic decentralization. There is a need that the above-mentioned acts are to be implemented with letter and spirit.

Ninth Five Year Plan

In Ninth Five Year Plan, chapter 7, there is a concern over urban explosive rise in vehicle including personalized transport, lack of adequate mass transport, high level of pollution, traffic jam, congestion and alarming rates of transport related injuries. Road safety under this plan receives priority. However, some progress has been made in this direction.

Intersectoral Involvement

The involvement of the following agencies / departments is needed to achieve the goal.

- Department Slum Development
- PWD
- Minis. of Planning, MoE&F, MOH&FW, M-I&B, MoUD, MoL, Municipal Bodies
- DST, ICMR, NIOH, NICD, Medical Colleges etc.

Recommendations

- Total coverage of slum and resettlement clusters should be made.
- Integration of all services by the unified local bodies is the need of the hour
- Primary education should be imparted to all
- Urban environment health, family life, stresses management training and traffic education should be imparted.
- Training for Self-sustained health care system should be introduced.
- Information should be provided to all citizens on fire hazards, injuries, natural disaster and other calamities and epidemics of infection.
- Provision should be made for facilities like schools, parks, playgrounds, library, creches, market etc. according to density of population.

3.1.2. SAFE DRINKING WATER, WATER POLLUTION AND SAFE SANITARY DISPOSAL*[2]

Safe Drinking Water

A substantial proportion of ill health in India can be attributed to lack of safe drinking water. Water used for human consumption, should be safe. Even when ingested over a prolonged period, drinking water should not have any harmful effects on human health. Safe and potable water is defined as water that is:

- *Free from pathogenic agents.*
- *Free from chemical substance.*
- *Pleasant to taste.*
- *Usable for domestic purposes.*

A daily supply of 150 – 200 liters (35- 40 gallons) of water per head is considered an adequate allowance. The average daily per capita minimum consumption of drinking water is around 2 liters, which varies considerably.

Water Pollution

Water pollution is the root cause of most of the water borne diseases and can be prevented or minimized to a great extent through provision of supply of safe water. Water is likely to be polluted as result of human activities like rapid unplanned urbanization, industrialization, agricultural pollutants, improper waste management etc. Quality of water and waste management are interdependent and has to be dealt with together to ensure supply of pollution free water.

Sources of pollution are sewage, industrial and trade waste, agricultural pollutants and physical pollutants. The common water pollutants can be broadly classified into:

Dr.P.G. Sengupta, Deputy Director, National Institute of Cholera and Enteric Diseases.
Prof. Shelley Bhattacharya, Environmental Toxicology Laboratory, Visa Bharati University, Santiniketan

Biological agents:

Virus: Hepatitis A virus, Poliovirus, Rotavirus, Adenovirus, Enterovirus, Norwalk virus

Bacteria: Vibrio cholerae O1 & O139, V. parahaemolyticus, E.coli, Shigella spp., Salmonella spp., Campylobacter jejuni, etc.

Protozoa: E.histolytica, G. lamblia, Cryptosporidium, Isospora, Microsporidium, Cyclospora, etc.

Chemical agents:

These can be further classified as:

- *Those occurring naturally in the water:*
  Include arsenic, lead, fluoride, nitrates and nitrites, etc.
- *Those which contaminate the water as a result of industrial and agricultural activities:*
  Includes pesticides, insecticides, arsenic, cadmium, cyanide, mercury, polynuclear aromatic hydrocarbons, etc.

Available Database

The public health impact of water pollution is enormous. A number of diseases with high morbidity and mortality are wide spread in the communities specially living in unsuitable environmental condition in urban slums and vast rural areas. A brief update of diseases primarily due to water pollution is given below.

♦ **Diarrhoeal Diseases:**

In India acute diarrhoeal diseases is one of the major consequences of not only water pollution but also of failure of proper management of sewage in both cities and rural areas. The disease mainly affects children below 5 years

of age. Diarrhoeal morbidity and mortality surveys in 1985 in both rural and urban areas in 11 States of India showed that median diarrhoeal incidence rate range from 1.0 to 4.7 episodes per child per year. In slum areas of major cities an incidence as high as 10.5 ep/ch/yr. was also reported. Of 3 million estimated diarrhoea associated annual deaths that occur globally, India alone accounts for one third of these deaths. Death due to diarrhoea shows a declining trend and currently it is around 0.6-0.7 million per year. About 50% of the deaths are due to dehydrating diarrhoea, 30-35% are due to persistent diarrhoea and the remaining 15-20% due to dysentery.

- **Cholera:**

Contamination of diverse sources of water with this pathogen has been documented. These include river water, pond water, water from tube wells apart from drinking water sources. In cities and towns the organism has been recovered from piped water supply at distribution points and also from point of consumption from water stored for drinking and domestic purposes. The endemicity of cholera is maintained through a cycle involving man – environment – man through water mainly. Besides recovery of V.cholerae O1 directly from water sources, the pathogen has been widely distributed in aquatic environment like copepods, crabs, water hyacinths etc. In Delhi, about 80% of water samples from tubewells were unfit for human consumption. Similar observations were also made by NICED during epidemic investigations in different parts of India. Both global and Indian cholera scenario has become further complicated during 1992-1993 with the introduction of a novel serogroup associated with cholera namely V.cholerae 0139. Originating from Madras in 1992, the disease has already affected majority of Indian states and adjoining countries. Total number of reported cases and deaths from cholera in India have shown a downward trend over the years. From 11423 reported cases in 1987 the number came down to 3704 in 1990. However, with emergence of V. cholerae O139 during the end of 1991 till 1993 the number of yearly reported cases increased to around

7000- 9000 due to large-scale outbreaks through out the country caused by this serotype.

- **Shigellosis**

The disease occurs both in epidemic and endemic form throughout India. Infective dose of the organism is very low (101-2) and its spread is facilitated under conditions of inadequate and / or poor water supply. In endemic shigellosis, the incidence of shigellosis usually peaks during hot humid months and also in rainy seasons. Epidemic shigellosis caused by Sh.dysenteriae 1 have been reported from different parts of India including South India (1976), West Bengal (1984) and Andaman & Nicrobar islands (1987) with high attach rate and case fatality rate.

- **Escherichia coli diarrhoea:**

Esch. coli diarrhoea occurs due to contamination of drinking water, food, particularly weaning food and also from person to person as a result of lack of personal hygiene. Five groups of diarrhoeagenic E.coli have been recognized namely Enterotoxigenic E.coli (ETEC), Enteropathogenic E.coli (EPEC), Enteroadherent E.coli (EAEC), Enteroinvasive E.coli (EAEC), and Enterohaemorrhagic E.coli (EHEC). Presence of E.coli has been used as an indicator of faecal contamination of water and food. In a recent rural community-based study carried out by NICED, E.coli was isolated from feeding utensils, left over food & drinking water, hand washings from study mothers and hand rinsing of study children.

- **Other water borne diseases**

1. **Poliomyelitis:**

In India, poliomyelitis is on the verge of eradication. Govt. of India has taken up the National Pulse Polio Immunization programme since 1995, for eradication of poliomyelitis from the country, through mass immunization campaigns, to all children under 5 years of age for interruption of transmission

of wild polio virus. The current status of polio indicate that in India there were only 1126 cases of poliomyelitis from where wild polio virus was detected in the stools of Acute Flaccid Paralysis cases as on 15th April 2000.

2. Typhoid:

Typhoid fever continues to be a major public health problem in developing countries including India. It has been estimated that of more than 12 million annual cases in the developing countries, 7.7 million cases occur in India alone. Morbidity rate from typhoid fever varies from 102 to 2219 per 100,000 population in different areas of the country. In a Delhi slum, an overall incidence of 9.8/1000 person year was observed and children below 5 years of age had the highest incidence (27.3/1000 person year).

In India, vaccination against typhoid fever is not included in the National Immunization Programme. However, typhoid remains one of the most important water and food borne infectious diseases in India.

Water borne viral hepatitis:

Viral hepatitis is widely prevalent in India. Hepatitis A & E are transmitted by faeco-oral route mainly due to faecal contamination of drinking water. It is primarily a disease of cities and smaller towns where unmaintained sewerage system and intermittent water supply exist. Common source epidemic due to contamination of drinking water resulting from improper excreta disposal, have been documented in India.

- **Diseases caused by Chemical pollutants:**

A number of chemical pollutants derived from industrial and agricultural wastes find their way into water and affect human health either directly or indirectly by accumulating in aquatic life used as human food. Besides acute toxic effects, long-term effects due to low level of exposure can lead to grave

and often undetected health hazards. The most important of these chemicals are arsenic, fluorine and lead.

1. Arsenic contamination:

Arsenic in its various chemical forms and oxidation states is released into aquatic environment by natural erosion process and industrial discharges. Mobilization of arsenic in sedimentary aquifers might be in part a result of changes in the geo-chemical environment due to agricultural irrigation. Arsenic contamination of ground water and its consequences on health have been reported from several parts of the world including India. In India, about 29% of water samples from wells and 35.7% from springs in and around Chandigarh were found to contain high amount of arsenic. Non-cirrhotic portal fibrosis was found after consumption of water from these sources. Arsenic dermatitis in West Bengal was first reported in July 1983. A survey in 1993 covering 5 seriously affected districts revealed that arsenic contamination of tubewell water varied between 15-50 %. Subsequent detailed survey showed that at least 1.2 million people are exposed to the risk of arsenic poisoning in North 24 Parganas district alone. Other districts where pockets of arsenic contamination of drinking water was found include Malda, Murshidabad, Nadia, South 24 Parganas, Burdwan, Howrah, Hoogly and recently, some parts of Calcutta city. Occurrence of arsenic contamination was reportedly confined to intermediate aquifers.

2. Fluorine:

Fluorine content in drinking water in most parts of India is 0.5 mg/l. But in 16 states of India which are endemic for fluorosis, the levels may be as high as 3 – 12 mg/l. Dental & skeletal fluorosis results from prolonged ingestion of excessive fluoride in drinking water and its inadequate intake results in dental caries. It has been observed that in the endemic areas as the level of ground water goes down, concentration of fluoride goes up. Estimated 62 million rural population is affected by fluorosis of which 6 million are children.

Diseases caused by faeco–orally transmitted enteric pathogens account for about 10% of total burden of disease in India. Statistics indicate that intestinal group of diseases which are primarily transmitted either faeco-orally or through person to person (cholera, acute diarrhoeal diseases, shigellosis, salmonellosis, typhoid fever, hepatitis A & E, ascariasis, giardiasis etc) claim about 5 million lives and about 50 million people suffer from these diseases every year. It has been also stated that DALYs (Disability Adjusted Life Years) lost in India are to the extent of 344/1000 population. Of these, 50.5% are due to communicable diseases.

Safe Sanitary Disposal

Proper disposal of human excreta and household wastes is fundamental to human health. The disposal of excreta and household wastes along with improvement of personal and domestic hygiene have a more direct relationship with the health status of a community than water supply alone. Inappropriate water supply and sanitation form the basic link between the disease agent and new susceptible hosts. Water and sanitation related infections and diseases of GI tract constitute 60-80% of the total illness. The health hazards due to poor environmental sanitation not only result in water pollution, but also causes a number of public health problems like soil pollution and food contamination.

The problem of sanitation should be separately categorized for those of the urban poor, those of the urban fringe population and those of the rural people. Majority of the rural population has no access to safe sanitary disposal facilities and use vast open fields for defecation. In rural areas even the basic and minimum sanitary services including drainage facilities and sullage disposal are non-existent in most villages. This has led to failure of controlling diseases that are related to water, soil, insects or food in spite of substantial progress in the field of water supply. An estimated 700 million people go out for open defecation. Less than 10% of the rural population is having sanitary latrines. Out of 4000 or more existing towns, only 200 cities and towns in India

have a sewerage system which is often partially maintained, ill-maintained or not maintained at all. Only a few of these have sewerage treatment plants, which frequently go out of operation. About 113 million houses have no toilet facilities and more than half a million children die every year due to preventable diseases that occur due to unsafe sanitary disposal. Annual incidence of enteric group of diseases was found to be 102-2119 per 100,000 population and hookworm disease was prevalent among estimated 45 million people.

Present status of water supply and sanitation in India

Since 1954, with the initiation of National Water Supply and Sanitation Programme, India's aim was to provide safe water supply and adequate drainage facilities for the entire urban and rural population. The Accelerated Rural Water Supply Programme (ARWSP) was launched as a supplement in 1972. In the successive 5 year plans, increasing amount of funds were made available for water supply and sanitation in India, however not much progress was achieved. In the 5th Five Year Plan, rural water supply, was included in the Minimum Needs Programme where problem villages were identified. International Drinking Water Supply and Sanitation Decade Programme was launched by Govt. of India in 1981. Targets set were 100% coverage for water for both urban and rural, 80% for urban sanitation and 25% for rural sanitation. The latest assessment indicates that safe water is available to around 85% of the total population and 16% population has access to adequate sanitation facilities, out of which 2% are in rural areas.

9th Five Year Plan

1. To sensitize the Panchayats and Nagar Palikas in the planning and implementation of Environmental Health activities on priority basis with the involvement and active participation of people, community and NGOs/ VOs.
2. To constitute a Joint Inter-Ministerial Working Group to examine the existing Environment Acts and the provision of the Model Public Health Bill

(Revised), 1978 and recommend a Comprehensive Environment and Health (Protection) Bill for consideration of the government.

3. To review Environmental Standards and Regulations from the point of view of health protection and available control technology.
4. To create a database linking Environment and Health covering such areas like routine environmental monitoring, health status of the population and strengthening of the existing systems.
5. To step up action under the centrally sponsored Scheme on Low Cost Sanitary Latrine particularly in the under- served areas like slums and urban fringes.
6. To take up cities growing at a rate more than the National average on a priority basis for provision of conventional sewerage.
7. To initiate action plans to provide and maintain water supply and sanitation facilities to all households in the rural areas through active involvement of communities and NGOs with appropriate amount of subsidy, loan and beneficiary participation. Water quality monitoring and surveillance should be ensured.
8. To strengthen environmental health surveillance and support services in the Ministry of Health and Family Welfare by establishing a division of Environmental Health and Sanitation and by strengthening existing institutes like NICD, NICED, AIIH&PH, NEERI, CS&E, NIOH, etc.

10th Five Year Plan

1. Inadequacy of safe drinking water

Although much progress has been made to provide adequate safe drinking water, there is still a problem of inadequacy especially in urban slums, urban fringe areas and rural areas. Grossly inadequate monitoring of water quality in both urban and rural areas has added to the problem of supply of safe water as is evident from recurrent outbreaks of water borne diseases. Water supply and sanitation have not been promoted as an integrated package involving government, NGOs and the community for sustainability.

2. Microbial contamination of drinking and domestic water sources

This results from discharge of untreated or partially treated sewage and bathing, washing and even ablution of people and also animals. Inadequate and ill-maintained sewage and sanitation facilities along with lack of control over discharge of these effluents along surface water sources / soil is the main problem processes involved.

3. Microbial contamination of water at the point of consumption

The problems arise in the water distribution system due to leakage in poorly maintained water pipes and seepage due to intermittent water supply. Improper storage and handling due to lack of awareness and bad personal hygiene also lead to contamination.

4. Chemical contamination of surface and ground water sources

This mainly results from discharge of untreated or partially treated sewage and industrial wastes and pesticides used in agriculture and leaching of hazardous wastes. Also, the natural presence of chemical contaminants like arsenic and fluorine in some areas has complicated the picture further.

5. Deterioration of water available from large water bodies

Unplanned and uncontrolled development by the side of such water bodies, discharge of wastewater and run off from surrounding localities, have resulted in such deterioration.

6. Inadequate sewerage and sanitation facilities

This has resulted from multiple causes. There is overall inadequacy and lack of maintenance in sewerage and sanitation facilities in urban areas and virtual non-existence of sanitary facilities in rural areas. In most of the urban areas including large cities, facilities are not available for connecting house drains to sewerage system. Rural people's age-old habit of defecating in open field and

acceptance and maintenance of low cost sanitary latrines has added to the problem.

New emerging issues

During the past two decades new, emerging and re-emerging communicable diseases have created public health problems. Research in NICED reported the emergence of *V. Cholera* 0139 Bengal in 1992. *Vibrio parahaemolyticus* has also emerged as a potential epidemic and pandemic strain. Shiga toxin producing *Esch. coli* belonging to 0157:H7 from dairy cattle & beef sample have also been detected, which has potential to cause severe haemorrhagic diarrhoea and fatality. Since 1997, human group B rotavirus (CAL Strain) has been recognized as a cause of human diarrhoea cases. This strain is the progenitor of ADRV (Adult Diarrhoea Rota Virus) which was responsible for epidemics amongst more than one million adults in China during 1982-84. Multi drug resistant *Shigella dysenteriae* 1 has caused severe epidemics in many parts of India including South India (1976), West Bengal (1984) and Andaman & Nicobar islands (1986). Newer parasites causing diarrhoea have been recognized and include cryptosporidium, cyclospora, microsporidium and isospora which are capable of causing severe disease specially amongst those who are immuno-suppressed (HIV infection) or acutely malnourished.

Researchable issues

Health research related to safe drinking water pollution and sanitary disposal include:

- Extent of population exposed to polluted drinking water, chemicals, fertilizers and pesticides. The burden of disease must be weighed against the cost-effectiveness of provision of safe drinking water and sanitary disposal.
- Extent of pollution of ground water & surface water in different regions and also in different settings.

- Epidemiological & Social Studies for social and behavioural risk factors related to disease occurrence, distribution and determinants, social aspects of open field defecation.
- Ecological studies to determine the survival of disease producing microorganisms in water, wastes, food and different vehicles of transmission.
- Changing trend of diseases with antimicrobial susceptibility pattern using modern molecular technologies available at present in the country.
- Development of new bio markers which can be categorized as:

a) Useful biological system for long term biomonitoring designed to detect changes in the aquatic ecosystem
b) Early warning bioindicators of xenobiotic action such as immunologic or reproductive effects
c) New set of biomarkers to detect water pollution by new range of xenobitoics released in the water

Recommendations

Safe Water

- To develop community based mechanism for improving access to environmental services.
- To increase efficiency of existing environmental service networks throgh rehabilitation, repair and the reduction of water wastage and leakage. This should be supported by demand management and more appropriate resource pricing.
- *To initiate localized community and household disinfection through education and awareness for storage in safe (narrow-neck) containers, handling and improving personal hygiene (hand washing with soap and water).*
- To increase the efficiency of storm water drainage system by cleaning and rehabilitating out fall canals and discharge channels.
- To ensure proper drainage of the effluents from domestic and industrial waste stream by improving solid waste management systems by encouraging waste collection, reduction, reuse, recycling and recovery and also removing toxic and hazardous wastes.
- To overcome ground water contamination with toxic chemicals like fluoride and arsenic, alternate sources of drinking water should be identified like utilization of local surface water sources and rainwater harvesting system and tapping of deep aquifers. Installation of arsenic removal plants, and use of domestic arsenic removal filters and defluoridation methods should be organized in a sustainable manner in affected areas with regular monitoring.
- To strictly impose regulations discouraging discharge of untreated sewage/industrial waste directly into water bodies.
- To prevent over exploitation of ground waters through community actions and appropriate legislative applications.

Safe sanitation

- To make available flush toilets and underground sewerage systems in cities and towns with special reference to urban slums and suburban areas.
- To accelerate community latrines in different districts which is presently making very slow progress.
- To strengthen promotion of low cost sanitary latrines with high priority in the absence of underground sewerage systems such as existing in rural areas and some towns.
- To promote such cost-effective and environment-friendly technologies like compost toilets in both rural and urban areas.
- To adopt the pay and use system for public toilets to make them economically viable.

To revamp O&M for the existing ill-maintained and under-utilized sewerage and sewerage treatment systems by completing the contributing sewerage systems and encouraging household connections.

3.1.3. OUTDOOR AIR POLLUTION*

Introduction

Outdoor air pollution is a major environmental issue facing the world. The health effects due to air quality came under public and scientific scrutiny as early as 1930s following several incidents of mortality due to air pollution. Several epidemiological studies have demonstrated a clear link between respiratory diseases and the levels of particulate in air pollution.

In India, the National Ambient Air Quality Monitoring Programme (NAAQMP) was initiated in 1984 and by 1995, it had a network comprising about 290 stations covering 90 cities with the Central Pollution Control Board (CPCB) overseeing the operations. CPCB carry out routinely monitoring of suspended particulate matter, sulpher dioxide, nitrogen dioxide in urban cities of the country. Following are the results (Air Quality Status and Trends in India, CPCB, October 2000).

Available Database:

(A) Air Pollution Levels

- **Suspended particulate matter**

The suspended particulate matter is one of the critical air pollutants in most of the urban cities in the country, and depicted frequent violations of standard at several monitored locations. Its general level remains consistently high in various cities during past several years.

The range of annual average and combined site average of SPM in major cities in India is given in Table 1.

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Table 1 Range of annual average and combined site average of SPM in major cities in India ($\mu g/m^3$) (1990-98)

Sr. No	City	Area land use	Range of annual average of annual SPM ($\mu g/m^3$) (1990-98)		Mean of annual averages ($\mu g/m^3$)	Combined site average ($\mu g/m^3$)
			Min	Max		
1	Delhi	Residential	300	409	355	368
		Industrial	314	431	381	
2.	Mumbai	Residential	196	327	230	227
		Industrial	150	276	224	
3.	Calcutta	Residential	205	491	327	381
		Industrial	286	640	434	
4.	Chennai	Residential	72	118	99	111
		Industrial	53	147	123	
5.	Bangalore	Residential	60	239	158	141
		Industrial	99	153	128	
6.	Ahmedabad	Residential	198	316	261	252
		Industrial	201	306	243	
7.	Hyderabad	Residential	135	184	158	156
		Industrial	72	259	153	
8.	Howrah	Residential	249	402	320	262
		Industrial	131	322	205	
9.	Patna	Residential	222	521	347	347
10.	Bhopal	Residential	153	307	221	260
		Industrial	185	396	298	
11.	Nagpur	Residential	146	252	190	178
		Industrial	115	245	165	
12.	Pune	Residential	79	247	185	220
		Industrial	185	374	254	
13.	Jaipur	Residential	203	429	283	261
		Industrial	176	320	238	
14.	Kanpur	Residential	329	424	390	423
		Industrial	377	522	457	
15.	Chandigarh	Residential	139	229	196	229
		Industrial	216	331	262	
16.	Pondicherry	Residential	97	203	152	170
		Industrial	94	320	187	

Source: Air Quality Status & Trends in India, CPCB, Ministry of Environment & Forests, Govt. of India, October 2000.

Maximum suspended particulate matter (SPM) values have been observed at Kanpur, Calcutta and Delhi, while low values being recorded in south Indian cities (Chennai, Bangalore and Hyderabad). The industrial activities have been vigorous at Kanpur and Calcutta with ferrous and non-ferrous casting, engineering, chemical units and several other industries are the major sources of particulate from combination of coal and high-speed diesel fuel apart from natural level of particulate matter.

Sulphur dioxide

The minimum, maximum and annual average of sulphur dioxide in various major cities in the country is presented in Table 2. The annual average level fluctuation of SO_2 was highest at residential areas of Howrah (West Bengal) recording between 40.6 $\mu g/m^3$ and 103.8 $\mu g/m^3$, while quite low at residential areas of Chandigarh and Jaipur ranging from 3.4 $\mu g/m^3$ to 10.0 $\mu g/m^3$ and 5.2 $\mu g/m^3$ to 9.4 $\mu g/m^3$ respectively. Among industrial areas, sulphur dioxide was recorded high at Pondicherry, Calcutta, Mumbai and Howrah, while low at Nagpur, Jaipur, Chandigarh. (Table-2). Thus Hawrah, Calcutta and Pondicherry, where annual average limit (60 & 80 $\mu g/m^3$ for residential and industrial areas) have been violated many times during past several years, had pollution problems due to sulphur dioxide.

The high level of SO_2 in these cities may be due to excessive industrial activities and prevalent in extensive use of sulfur fossil fuel and other sulphur bearing fuel for combustion processes.

Table 2 Range of annual average and combined site average of SO_2 in major cities ($\mu g/m^3$) (1990-98)

Sr. No	City	Area land use	Range of annual average of annual SPM ($\mu g/m^3$) (1990-98)		Mean of annual averages ($\mu g/m^3$)	Combined site average ($\mu g/m^3$)
			Min	Max		
1	Delhi	Residential	7.3	16.5	14.65	17.86
		Industrial	15.1	25.7	21.06	
2.	Mumbai	Residential	12.9	29.5	20.42	27.47
		Industrial	23.4	56.7	34.52	
3.	Calcutta	Residential	19.5	58.0	35.33	40.74
		Industrial	25.0	73.7	46.16	
4.	Chennai	Residential	6.8	10.5	8.37	14.30
		Industrial	8.5	31.8	20.23	
5.	Bangalore	Residential	17.1	41.6	25.66	25.05
		Industrial	19.8	35.3	24.44	
6.	Ahmedabad	Residential	14.9	38.3	24.97	22.97
		Industrial	15.4	30.0	20.96	
7.	Hyderabad	Residential	6.6	18.3	11.87	13.01
		Industrial	8.2	19.3	14.14	
8.	Howrah	Residential	40.6	103.8	74.02	53.87
		Industrial	22.9	42.7	33.70	
9.	Patna	Residential	9.4	26.2	16.66	16.66
10.	Bhopal	Residential	6.4	17.2	11.41	12.89
		Industrial	9.3	20.9	14.36	
11.	Nagpur	Residential	6.0	8.6	7.54	8.23
		Industrial	6.2	10.4	8.91	
12.	Pune	Residential	7.8	50.3	28.70	32.14
		Industrial	15.6	55.9	35.59	
13.	Jaipur	Residential	5.2	9.4	7.50	9.13
		Industrial	6.7	14.7	10.74	
14.	Kanpur	Residential	7.7	16.5	11.87	12.89
		Industrial	7.6	18.5	13.92	
15.	Chandigarh	Residential	3.4	10.0	5.27	8.42
		Industrial	5.8	19.0	11.57	
16.	Pondicherry	Residential	3.6	32.0	18.38	32.33
		Industrial	18.8	91.0	46.27	

Source: Air Quality Status & Trends in India, CPCB, Ministry of Environment & Forests, Govt. of India, October 2000.

Nitrogen dioxide

Annual mean concentration, minimum and maximum value of nitrogen dioxide in major urban areas of the country is presented in Table 3.

Table 3. Range of annual average and combined site average of Nitrogen Dioxide (NO_2) in major cities in India ($\mu g/m^3$) (1990-98)

Sr. No	City	Area land use	Range of annual average of annual SPM ($\mu g/m^3$) (1990-98)		Mean of annual averages ($\mu g/m^3$)	Combined site average ($\mu g/m^3$)
			Min	Max		
1	Delhi	Residential	22.0	32.9	30.09	31.24
		Industrial	23.4	36.8	32.38	
2.	Mumbai	Residential	25.3	37.0	30.34	32.23
		Industrial	23.4	51.5	34.11	
3.	Calcutta	Residential	25.3	41.2	31.88	33.34
		Industrial	26.0	40.2	34.80	
4.	Chennai	Residential	9.5	32.3	15.84	16.39
		Industrial	8.7	24.9	16.96	
5.	Bangalore	Residential	11.2	31.0	20.96	19.14
		Industrial	11.4	23.2	17.32	
6.	Ahmedabad	Residential	13.7	32.9	23.25	23.19
		Industrial	16.5	35.0	23.14	
7.	Hyderabad	Residential	16.4	33.3	23.93	23.58
		Industrial	8.3	47.2	23.23	
8.	Howrah	Residential	72.0	217.2	127.09	113.67
		Industrial	44.0	185.6	100.24	
9.	Patna	Residential	12.9	29.0	21.91	21.91
10.	Bhopal	Residential	5.5	26.2	17.75	18.54
		Industrial	8.6	28.9	19.31	
11.	Nagpur	Residential	8.3	17.8	14.32	15.34
		Industrial	9.8	26.4	16.35	
12.	Pune	Residential	8.5	60.4	37.48	40.25
		Industrial	18.4	61.8	43.02	
13.	Jaipur	Residential	11.9	27.3	20.78	22.46
		Industrial	11.4	42.0	24.13	
14.	Kanpur	Residential	11.2	21.8	15.42	16.55
		Industrial	11.9	55.9	17.67	
15.	Chandigarh	Residential	4.5	29.7	15.47	16.73
		Industrial	5.1	34.0	17.98	
16.	Pondicherry	Residential	9.7	50.5	28.93	35.97
		Industrial	15.5	91.4	43.01	

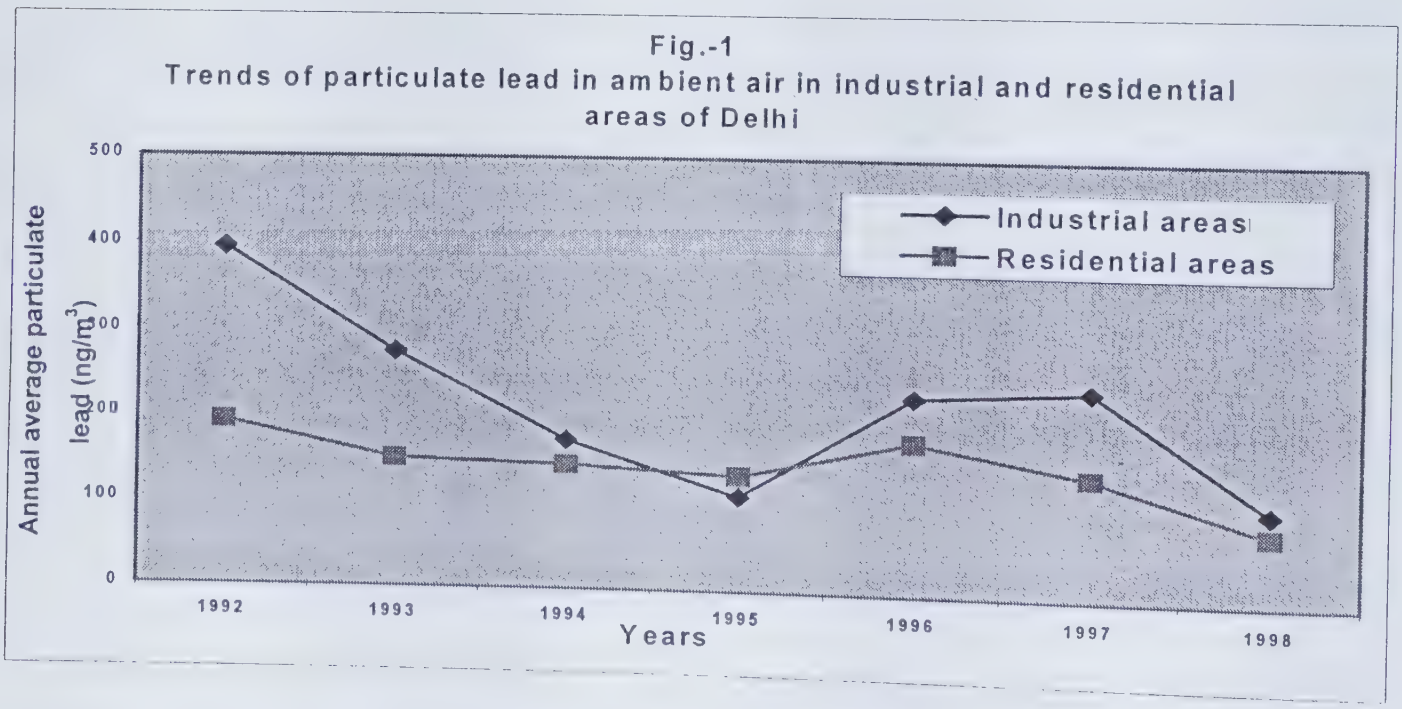
Source: Air Quality Status & Trends in India, C.P.C.B., Ministry of Environment & Forests, Govt. of India, October 2000.

The air quality monitoring data indicate that annual average of nitrogen dioxide had been well within the annual average limit (60 $\mu g/m^3$ for residential areas and 80 $\mu g/m^3$ for industrial areas) at most urban cities except violations in some years at residential as well as industrial areas of Hawrah, Vishakhapatnam and Kota. This high trend may be due to contributions of gaseous pollutants from combustion processes in industrial areas.

Particulate lead

The monitoring of particulate lead in major urban cities in the country have been initiated by NEERI and CPCB during last few years. The trend of particulate lead from 1992 to 1998 is presented in figure-2, which indicates fluctuating trend of particulate lead upto 1996 at residential areas and after ward there have been down ward trend both at residential and industrial areas mainly because of introduction of lead free gasoline in the mega city along with other cities.

Fig.-1
Trends of particulate lead in ambient air in industrial and residential areas of Delhi



CPCB has decided to monitor carbon monoxide, respirable suspended particulate matter (RSPM), benzene and ozone from 2001.

- **Vehicular Pollution**

Vehicular pollution is due to the following.

(a) Increase in population of vehicles, particularly personal vehicles.

(b) Most of in-use vehicles are having traditionally designed engines and are high emitters of pollutants.

(c) High emissions of carbon monoxide and hydrocarbons from 2 and 3 wheelers, consisting of 2-stroke engines.

(d) Inadequate road and traffic network unable to meet the needs of the increasing population.

Table-4 shows the significant increase in vehicular population in the cities.

Table-4 : Year wise vehicular population (in lakhs)

City	31.3.1975	31.3.1985	31.12.1998
Delhi	2.35	8.41	31.67
Mumbai	2.21	4.41	-
Bangalore	0.89	2.78	-
Calcutta	1.26	3.11	-
Madras	0.48	1.66	-
Ahmedabad	0.57	1.77	-

(-)suggests data not available

Vehicular pollution contributes major portion of air pollution in the cities. In Delhi, vehicular pollution contributes 64% of the total air pollution as per the estimate carried out by CPCB.

According to the 1998 NAAQMP data, the PM_{10} (Particulate Matter, less than 10 micron) levels in the residential areas of Delhi are critical (>210$\mu g/m^3$). However, in a recent press report, the CPCB claimed a reduction in the PM_{10} levels in Delhi this year compared to past years. It is estimated that about 3000 metric tones of air pollutants are emitted every day in Delhi. The predominant sources are emissions from vehicles (67%), coal-based thermal power plants (13%), industrial units (12%) and domestic (8%). It is projected that Delhi may have 6 million vehicles by

2011. Currently, two wheelers account for about two-thirds of the total vehicular population. This is an important factor in considering any strategy to reduce pollution since the inherent drawbacks in 2 stroke engines allow them to emit about 20% - 40% of the fuel unburnt or partially burnt. In addition, it is an inescapable fact that petrol is widely believed to be adulterated with kerosene, which results in emissions of thick black smoke that citizens of Delhi are well aware of. The presence of old vehicles, overloaded buses, diesel trucks and the growing numbers of three wheelers on the streets only compounds the problem.

The Government of India shifted its policy from pollution control to pollution prevention from 1994. Following actions have been taken for minimizing vehicular pollution.

- Phased switchover from leaded to unleaded petrol since 1995 in the metro cities to start with
- Introduction of Vehicular Pollution Checks of all vehicles plying on the roads in the metropolitan cities coupled with phasing out the old vehicles and replacement of two stroke engines.
- Improved engine efficiency coupled with use of catalytic converters in the new vehicles. Supreme Court direction stipulates the adoption of Euro-I and Euro-II emission norms in a time bound manner.
- Introduction of low-sulphur diesel and low benzene gasoline in a phased manner along with promotion of alternative fuels like Compressed Natural Gas (CNG)
- Revision of emission norms.

The details of indoor air pollution and industrial air pollution are given elsewhere (Chapter-III).

(b) Health Effects:

Health effects of various pollutants due to industrial pollution, vehicular pollution, ambient air pollution or domestic pollution is well documented in the

literature. The air pollution damage the human respiratory and cardio vascular system in various ways leading to further complications. The children, elderly, smokers and those with chronic respiratory difficulties are most vulnerable group of population.

Over the past few years, several studies have looked at the health effects of inhalable PM. They have used different end points such as mortality, hospital admissions for respiratory illnesses, emergency department visits for respiratory symptoms, lung functions (FEV_1, $FEV_{0.75}$, peak expiratory airflow), asthma attacks and bronchodilator used to quantify the effects of air pollution. The alarming results from mortality studies have aroused public concern about the deleterious effects of air pollution and promoted means of tighter control.

There is a relative paucity of data from India but some of the studies that have been published clearly implicate PM and other air pollutants adversely affecting health. In a cohort study (Awasthi et al) of 664 pre-school children in Lucknow every fortnight for a period of one year. It was concluded that SPM, SO_2 and NO_2 levels were associated with an increased incidence of respiratory symptoms. A recent study from Calcutta by Lahiri et al. compared the respiratory symptoms complex, sputum cytology and presence of micronucleus in buccal epithelium in children from Calcutta and those from a rural area in the same state. They found that urban children had a higher prevalence of the respiratory symptom complex and also had significantly increased numbers of neutrophils, eosinophils and iron laden alveolar macrophages in the sputum.

NIOH study showed significantly higher prevalence of the respiratory symptoms than the controls and relatively decreasing trend was observed in 2835 men and 2293 women from 10 exposed villages within 5 kms radius of the GIDC Industrial area, Vapi (South Gujarat). ROHC (E) finding suggest that the inhabitants of the surrounding village of the NALCO smelter plant, Angul,

(Orissa) had health problems which are indicative of exposure to fluoride, as indicated by mottling of teeth resembling fluorosis, hypopigmentary skin lesion resembling Chizola, higher alkaline phosphatase levels and the body abnormalities like calcification of inter-osseous membrane, tendo-achilis, arteries as well as thickening of bones. The epidemiological studies carried out at various critically polluted areas by MoEF also indicate that the incidence of symptomatic morbidity (eye irritation, respiratory problem, and skin lesion/irritation) was high in the areas of industrial activity.

NIOH study of 633 children (Age group below 12 years) residing in Ahmedabad city, who are exposed to auto exhaust pollution, had blood lead level ranging from 6.3 – 23.1 μg/dl with a mean of 9.7 μg/dl; while 705 children residing near the smelting plant at Calcutta had blood lead level ranging from 2.4 – 27.2 μg/dl with a mean of 9.3 μg/dl. About 38% students in Ahmedabad and 30% students of Calcutta had lead levels higher than the 10 μg/dl, which is high risk level as per CDC, USA categorization. Study carried out by Georage Foundation (1999) in 1852 children in five mega cities (like Bangalore, Calcutta, Chennai, Delhi and Mumbai) showed that 51.4% children had blood lead levels above 10 μg/dl. They also reported that children having higher blood lead level had increased absenteeism, lower vocabulary and reasoning score.

It is becoming increasingly apparent that the health hazards of outdoor air pollution and the means to control it are the core of concerns of diverse groups in our society. Industry and business groups are eager to challenge the newer regulations even as environmental researchers and health policy advocates want to strengthen them based on the scientific data available. It is difficult to project exact health burden due to outdoor air pollution, but it is at present a major public health problem. Adequate measures are still needed to be taken to control the environmental degradation of the urban and industrial areas.

Emerging Issues

Environmental health cell at Ministry of Health and Family Welfare/ICMR may be created with NIOH, Ahmedabad or AIIMS, New Delhi or PGIMER, Chandigarh may become as a nodal agency. This cell will carry out and monitor following activities.

1. Area wise maping of environmental pollution vis-a-vis prevalence of pollution related health problems.
2. Awareness and education activities

   Use of various means of information dissemination including the media to increase public awareness on the need of minimising pollution and maintaining good health.
3. Management and rehabilitation programmes.

   There is a great need of such programme for chronic disability especially from pollution related cardio respiratory disability. The activities may include provision of organized domiciliary care and hospice services.

Researchable Issues

1. Epidemiological studies

- To find burden of diseases and their association with pollution, causes and confounders.
- To assess effects of pollution on morbidity and mortality
- To estimate economic losses and costs of management of pollution related health problems.

2. Clinical studies

- To evaluate pollution related dysfunction, and diseases for their clinical spectrum and management.
- Toxicological and experimental studies for mechanisms and outcome.
- Exposure assessment and measurements of different pollutants.

Inter-sectoral Involvement

- Indian Council of Medical Research/NIOH – for research issues
- Institute of Medical Education & Research such as AIIMS, New Delhi and PGIMER, Chandigarh.
- Ministry of Health – Central and State
- Ministry of Social Welfare
- Ministry of Environment & Forests
- Others including NGOs.

Recommendations

- Environmental Health Cell should be created at the Ministry of Health & Family Welfare, Govt. of India.
- National Database should be created with reference to environmental pollution related to health problems.
- Awareness and education activities related to environmental health, should be created through various media.

3.1.4. SOLID WASTE MANAGEMENT*

Introduction

Solid Waste Management is an obligatory function of Urban Local Bodies (ULBs) in India. However, this service is poorly performed, resulting in problems of health, sanitation and environmental degradation. On account of over 3.6% annual growth in urban population and the rapid pace of urbanization, the situation is becoming more and more critical with the passage of time. Lack of financial resources, institutional weakness, improper choice of technology, and lack of support from public, towards Solid Waste Management (SWM) has made this service far from satisfactory.

Available Database:

Present Scenario of Solid Waste Management (India)

- **Waste Generation:**

In most of the Indian cities, waste is measured by volume to determine the quantity of waste disposed of. Waste generation ranges from 200 gms to 500 gms per capita per day in cities ranging from 1 lakh to over 50 lakhs population, as shown in Table-1.

Table- 1
Waste Generation per Capita

Population Range (In Lakhs)	Average per capita waste generation Gms/capita/day
1 to 5	210
5 to 10	250
10 to 20	270
20 to 50	350
50 & above	500

Source: NEERI Strategy paper on SWM in India February, 1996

*Dr. D.J. Parikh, Deputy Director (Sr. Grade), NIOH, Ahmedabad; Dr. A.D. Bhide, Retd. Director Grade Scientist, NEERI, Nagpur.

The larger the city, the higher is the per capita waste generation rate. The total waste generation in urban areas in the country is estimated to exceed 39 million tonnes a year by year 2001, and estimated at 62 million tonnes a year by year 2025. It is estimated that about 80,000 metric tonnes of solid waste is generated everyday in the urban centers of India. At present about 60% of the generated solid wastes is collected and unscientifically disposed off. The un-collected solid wastes remains in and around the locality or find its way to open drain, water bodies, etc.

According to a survey carried out by the Central Pollution Control Board (CPCB) in 1998, it is observed that the total quantity of solid waste generated by 23 metro cities of the country is about 30,058 tonnes per day. Mumbai generates the maximum with 5,355 tonnes per day while Vishakhapatnam with 300 tonnes per day (Fig. 1a). In terms of per capita waste generation, Madurai leads with 0.92 kg per day and Nagpur with 0.272 kg per day, which is the least per capita generator (Fig.-1b). It is observed that quantity of per capita waste produced in India is much less than other developed countries.

- **Composition of Waste:**

In Indian waste, there is a small percentage of recyclable material and more of compostable and inert materials like ash and road dust. There is a very large informal sector of rag pickers, which collects recyclable waste from the streets, bins and disposal sites. They pick up paper, plastic, metal, glass, rubber, etc., for their livelihood, but a small quantity of recyclable material is still left behind. The physical and chemical characteristics of Indian waste are given in Tables 2 & 3.

Table – 2
Physical Characteristics of Municipal Solid Waste in Indian Cities

Population range (In Millions)	No. of cities surveyed	Paper	Rubber-leather & synthetics	Glass	Metal	Total compostable matter	Inert material
0.1 to 0.5	12	2.91	0.78%	0.56	0.33	44.57	43.59
0.5 to 1.0	15	2.95	0.73%	0.56	0.32	40.04	48.38
1.0 to 2.0	9	4.71	0.71%	0.46	0.49	38.95	44.73
2.0 to 5.0	3	3.18	0.48%	0.48	0.59	56.67	40.07
5.0 & above	4	6.43	0.28%	0.94	0.80	30.84	53.90

** All values are in percent, and are calculated on Net Weight basis*
Source: NEERI Reports, Strategy Paper on SWM in India, Aug. 1995

Table – 3

Chemical Characteristics of Municipal Solid Waste in Indian Cities

Population range (In millions)	Nitrogen as Total Nitrogen	Phosphorus as P_2O_5	Potassium as K_2O	C/N Ratio	Calorific Value Kcal/kg.
0.1 to 0.5	0.71	0.63	0.83	30.94	1009.89
0.5 to 1.0	0.66	0.56	0.69	21.13	900.61
1.0 to 2.0	0.64	0.82	0.72	23.68	980.05
2.0 to 5.0	0.56	0.69	0.78	22.45	907.18
5.0 & above	0.56	0.52	0.52	30.11	800.70

Source: NEERI, Strategy Paper on SWM in India, Aug. 1995

As per NEERI Studies compostable matters range from 30% to 57% and inert materials from 40% to 54%. Recent NEERI study indicates (Fig.-2) maximum compostable matter is 41.8%, whereas paper and plastic comprises of nearly 8%, glass 2.1%, metal 1.9% and others 44.6% respectively, in solid waste.

Present Scenario of Solid Waste Management (International Level)

Today, the urban areas of Asia produce about 760000 tonnes of Municipal Solid Waste (MSW) per day, or approximate 2.7 million m^3 per day. In 2025, this will increase to 1.8 million tonnes of waste per day, or 5.2 million m^3 per

day. Local governments in Asia are currently spending about US $ 25 million per year for urban solid waste management (World Bank, 99).

It is observed from solid waste generation and its composition, that organic matter in the urban waste stream is produced between 18% & 50% in developed countries, while in Asian countries (low and middle income countries), it is between 40% to 85% of the total waste generation (Figures 3 & 4).

Environmental & Health Issues:

Environment, Health and Safety are the main concerns arising from improper solid waste management. Human faecal matter is commonly found in municipal waste. Vector, insect and rodent are attracted to the waste and can transmit various pathogenic agents (like amoebic and bacillary dysentery, typhoid fever, salmonellosis, various parasites, cholera, yellow fever, plague, etc.) and diseases, which are often difficult to trace the effects of such transmission to a specific population. During the last decade of the 19th century, as well as during the five initial years of 20th century, millions of people died due to Bubonic Plague in India, which had linkages to poor management of solid waste.

Epidemiological studies have clearly shown that workers engaged in Solid Waste Management (SWM) Services are exposed to high health risk and frequently suffer from respiratory tract infections, gastro-intestinal parasites and worms. The organic matrix of solid waste provides food and shelter to disease – carrying rodents and insects. Indian domestic waste contains human excreta, bio-medical waste and sometimes other toxic and hazardous wastes. Improper management of waste can therefore spread several diseases. The U.S. Public Health Services Studies have indicated that 22 diseases are directly linked to improper solid waste management practices. The rag pickers, who move from street to street, are most vulnerable to diseases due to their direct contact with contaminated waste. They are found to suffer from intestinal and respiratory infections, skin disorders and eye

infections. They also suffer from tetanus and serum hepatitis due to injuries at open dumps. Improper disposal of waste also pollute ground waste resources with heavy trace metals and other contaminants through leachates, which pose serious problems of environmental deterioration and health risk Exhaust fumes from waste collection vehicles, dust from disposal practices and open burning of waste also contributes to overall health problems in urban areas. More serious and often unrecognized, is the transfer of pollution to ground water. Air pollution can be caused from the inefficient burning of wastes, either in open air or in plants that lack effective treatment facilities from the gaseous effluents.

Uncontrolled hazardous wastes from industries mixing up with municipal domestic waste create potential risks to human health. Sometimes, traffic accidents can result from toxics spilled wastes. Overall, Environment and Health Hazards associated with solid wastes can be divided into five categories as shown in Table-4. It is required to safeguard environment and health through proper intervention and preventive measures.

Table – 4

Types of Environmental and Health Hazards

Environmental and Health Hazards	Examples and Causes
Environmental Pollution	Air quality deterioration, water quality deterioration, noise pollution, dust.
Communicable Disease	Gastrointestinal disorders, diarrhoea, respiratory infection, skin diseases, jaundice, trachoma, eosinophilia, etc.
Non-Communicable	Hearing defects/loss,
Injury	Occupational injury by sharps, needles, glasses, metals, wood, , etc.
Aesthetics	Odour, visibility, etc.

Legislation:

Public Health and Sanitation falls within the purview of State Laws. Collection and disposal of solid wastes is of local nature and is entrusted to local civic authorities and forms its obligatory duty.

Local civic authorities in some states like U.P., Punjab, Bihar, Tamil Nadu and West Bengal are governed by old laws passed in 1916, 1911, 1920 and 1932 respectively, which deal with collection and transport of the waste. These old regulations deal with domestic and to some extent, trade waste only and that too only cursorily. They do not provide sufficient powers to civic authorities for offenders with the result that enforcement becomes ineffective.

The recently promulgated Municipal wastes (management and handling) Rules 2000 are a step in the right direction. The provision of these rules needs to be vigorously implemented.

Researchable issues:

Following are the new emerging researchable issues, which require to be studied.

1) Health Hazards in formal and informal Workers engaged in Solid Waste handling and disposal like rag pickers.
2) Microbiological degradation of pesticides in composting of waste including yard waste
3) Human exposure to dioxin Polyclorinated Dibenzo p-Dioxins (PCDD) and Polychlorinated Dibenzo Furans (PCDF) in biomedical waste incinerators.
4) Study of enteric viruses in solid waste landfill leachtes.
5) Extensive data should be compiled to enable exposure and epidemiological studies to be carried out related to hazardous waste, including biomedical wastes.
6) A comprehensive research programme is carried out to determine the effects of hormonally active synthetic chemicals on human health. The

adverse impact of hormone-disrupting chemicals on living system requires to be studied.

9th Plan Programmes:

During the 9th plan, following achievements were made.

- The planning Commission, Govt. of India constituted a high power committee on urban solid waste management. The committee recommended safe methods for collection, transportation of waste and suitable cost effective and environmental friendly methods for disposal of this waste.
- A pilot project on hospital waste management in Delhi was initiated.
- The Bio-medical waste (Management and Handling Rules) 1998 was notified.
- Manual on "Municipal Solid Waste Management" was prepared by a committee of Experts constituted by the Ministry of Urban Development, which was published in May 2000 and is being widely circulated.
- The Ministry of Urban Development constituted Technology Advisory Group on Solid Waste Management in August 1999. They gave recommendations on various technologies for processing and disposal of wastes suitable under Indian conditions.
- Municipal waste (Management & Handling) rules 2000 was notified.

Inter Sectoral Involvement:

solid waste management is a state subject. However, this programme at the national level is looked after by the Ministry of Urban Development & Poverty Alleviation, Govt. of India, as well as Ministry of Environment and Forest, Ministry of Health and Family Welfare, Ministry of Agriculture, Central Pollution Control Boards (CPCB), State Pollution Control Boards (SPCB), Urban Developments of the State Governments, Commissionrates / Directorate of Municipal Administration at the state level and respective municipal corporations and municipalities.

Recommendations

- Feasible, economical and suitable technologies for processing of the Solid Waste should be tested in Indian conditions.
- All Field level staff should be given one day training every year.
- At lease 20% of the Middle level staff should be given training for fifteen days every year.
- Senior level staff should be given one week training once in every two years.
- School children should be involved in the various campaigns mounted by the non-governmental organizations for improved community participation in the collection and transportation activities.
- All means of mass communications (TV advertisement, posters, newspaper articles and advertisements, etc.), regarding maintenance and cleanliness of various localities should be made.
- A sustained campaign should be mounted to achieve separation of various recyclable constituents (paper, plastic, metals etc.) at the source so that better recycling than hitherto occurs and the quantity of waste to be transported and disposed of is reduced.
- Clean area contests should be instituted for different areas and the best-maintained areas as well as the workers involved therein should be awarded prizes.
- Citizens' forums involving citizens representatives, social workers and concerned municipal officials should be created who should identify the capacity of community bins to be placed in appropriate locations and also frequently supervise proper cleaning of such bins.

In addition to the recommendations given above the recommendations given by the high power committee constituted by an order of the Supreme Court of India is given in Annexure – I.

ANNEXURE - I

The recommendations of the high power committee regarding management of hazardous wastes, constituted by an order of the Supreme Court of India, are as follows.

1. SPCBs (State Pollution Control Board) should be directed to close forthwith all units within their jurisdiction that are operating without authorization as required under the HW Rules 1989/2000.
2. SPCBs should be directed to close all units within their jurisdiction that have been issued authorizations, but have not compiled with the conditions laid down in the letters of authorization, or have violated these.
3. Authorization for any unit should not be issued or renewed until the following prerequisites are met:
   - 3.1. Occupiers must certify in writing that they have a programme in place to reduce the volume or quantity and toxicity of hazardous wastes to the degree determined by them to be economically practicable; and,
   - 3.2. That they find, through a comparative analysis of various technologies and processes, that the proposed method of treatment, storage or disposal is the most practicable method currently available to them which minimizes the present and future threat to human health and environment.
4. In addition to (3) above, the concerned SPCB should evolve a mechanism or checklist, to ensure that an authorization to any unit generating or handling hazardous waste is granted only where it is justified by the availability of adequate treatment and disposal facilities and of adequately trained manpower. The authorization should be renewed only when, additionally, (a) the conditions prescribed by the SPCB have been duly observed by the occupier,

(b) proper measures for the protection of health of workers have been taken, and (c) a sound record of compliance with regulatory requirements imposed earlier has been maintained.

5. It is imperative that Government declares and takes steps to ensure that expansion of existing hazardous waste generating industries and new industries of this nature follow the basic parameters of Clean Production. New industries must be subjected to stringent public disclosure rules regarding emissions, processes, raw materials and hazard potential, and mitigation scenarios. Such industries must prove that the processes used are the most energy-efficient and environmentally safe technologies when submitting their proposals for seeking consent to establish. They must not be permitted to employ technologies or processes that intentionally or unintentionally generate endocrine disrupting chemicals or persistent organic pollutants.

Fig. : 1a Solid waste Management Scenarios in India (1998)

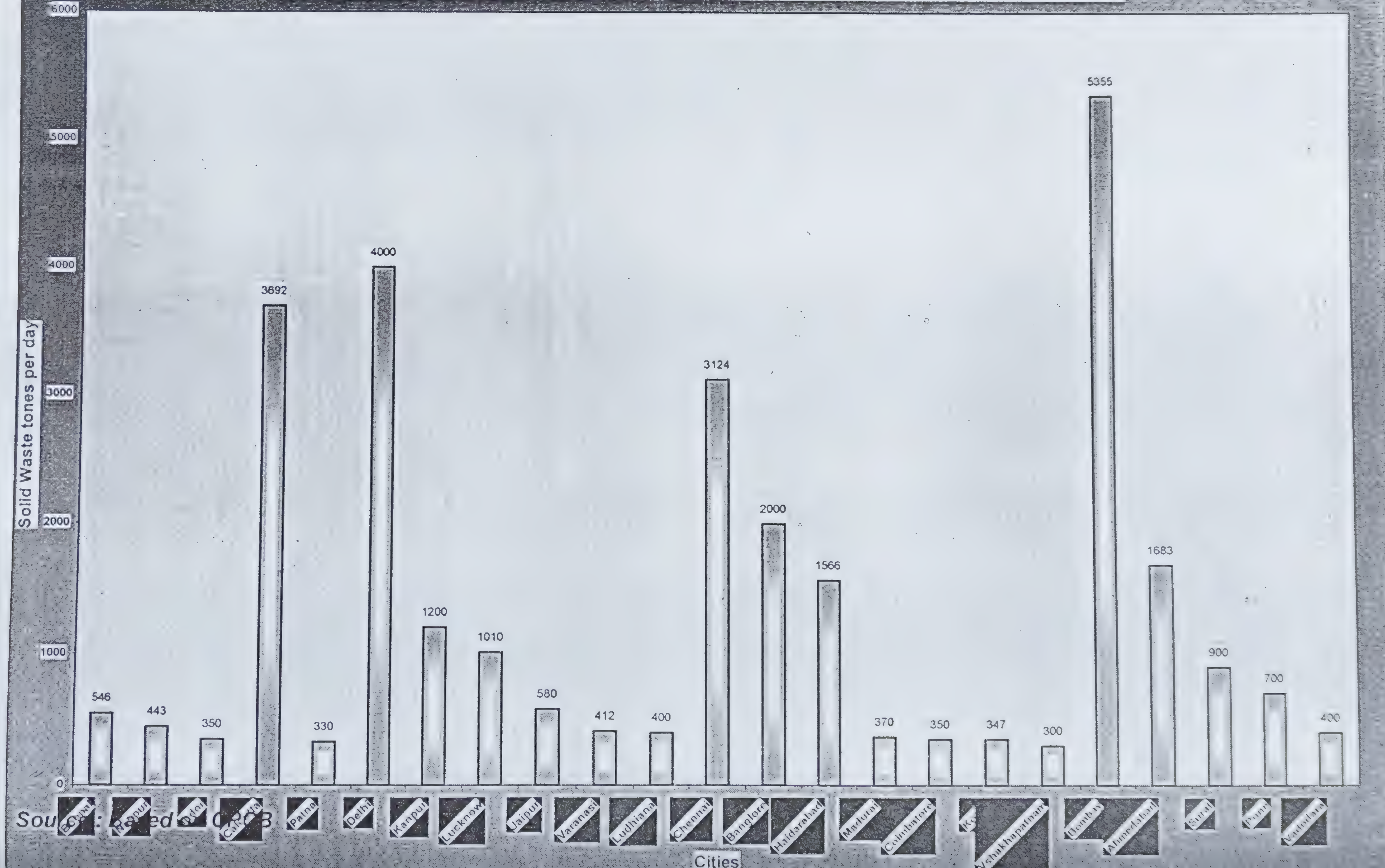
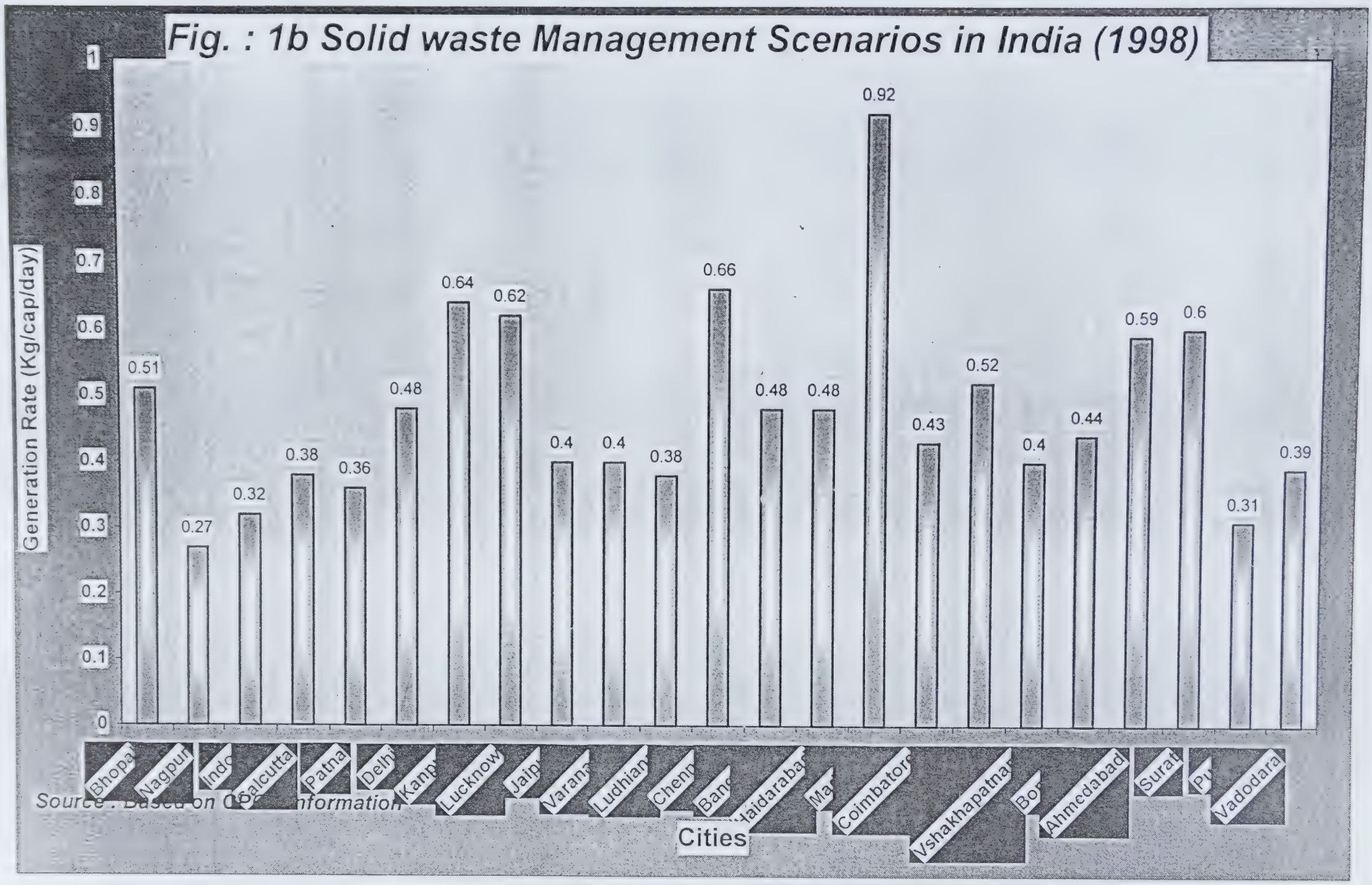


Fig. : 1b Solid waste Management Scenarios in India (1998)



Source : Based on CPCB information

Fig. : 2 Composition of Solid Waste in India

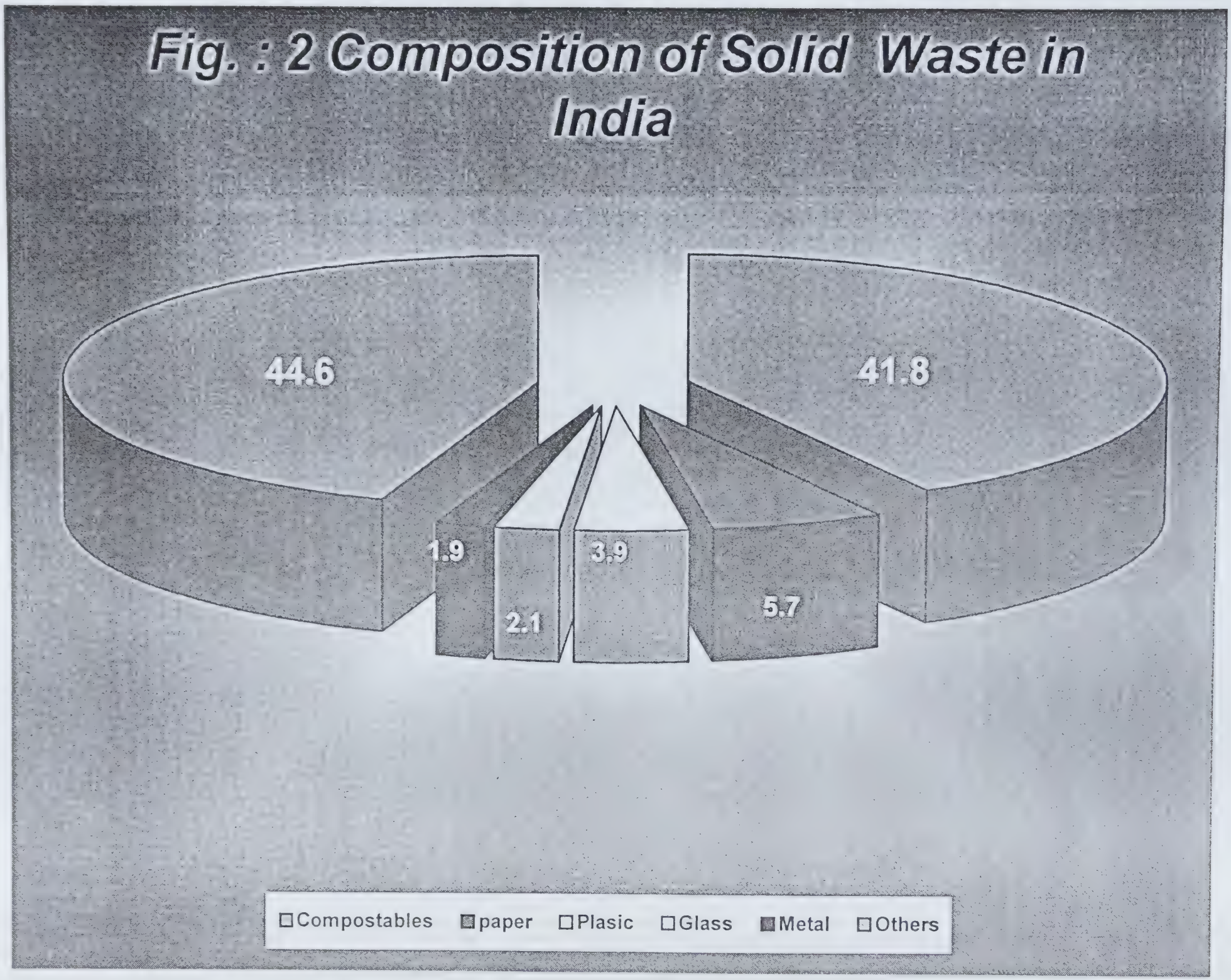
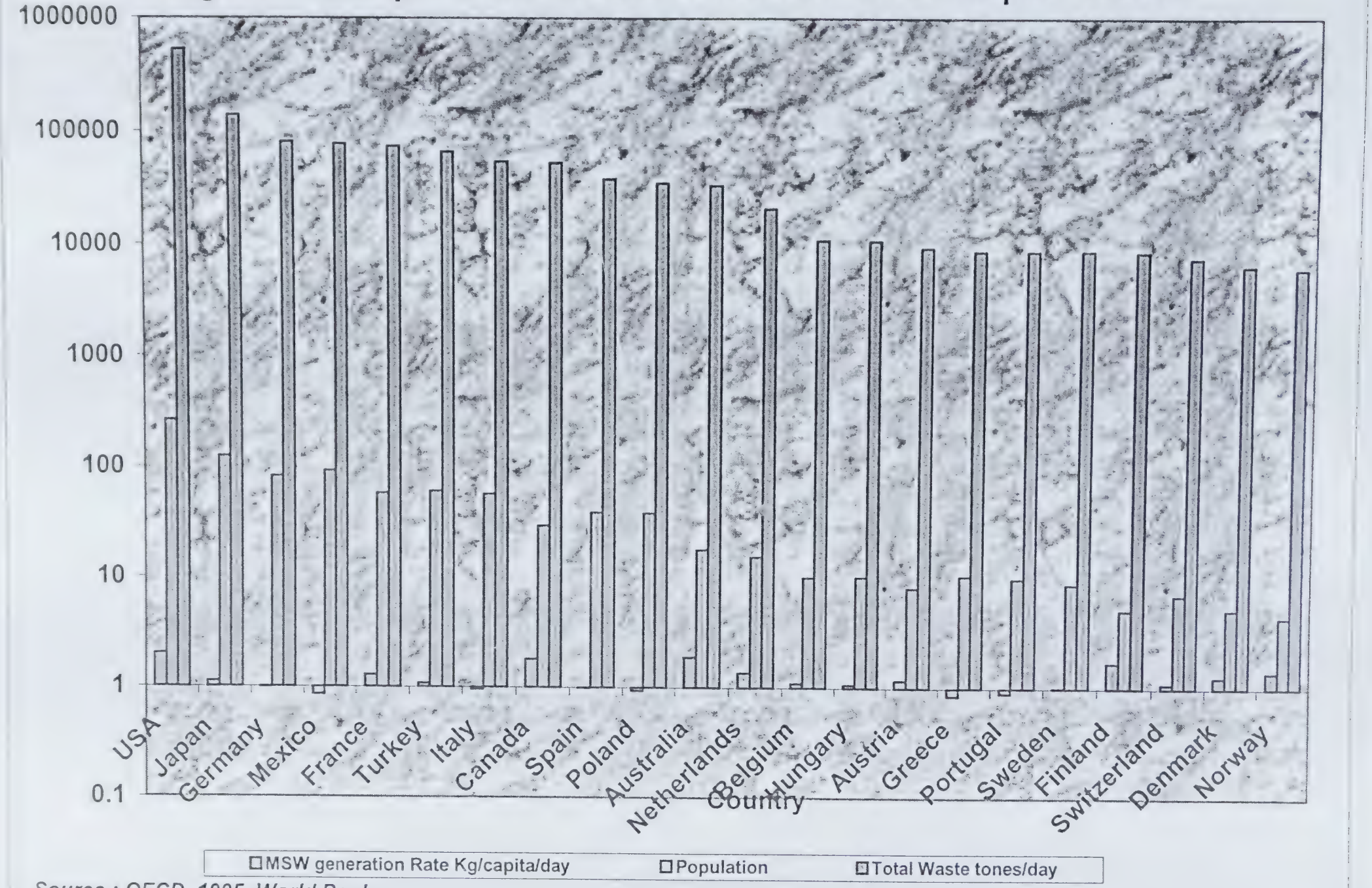
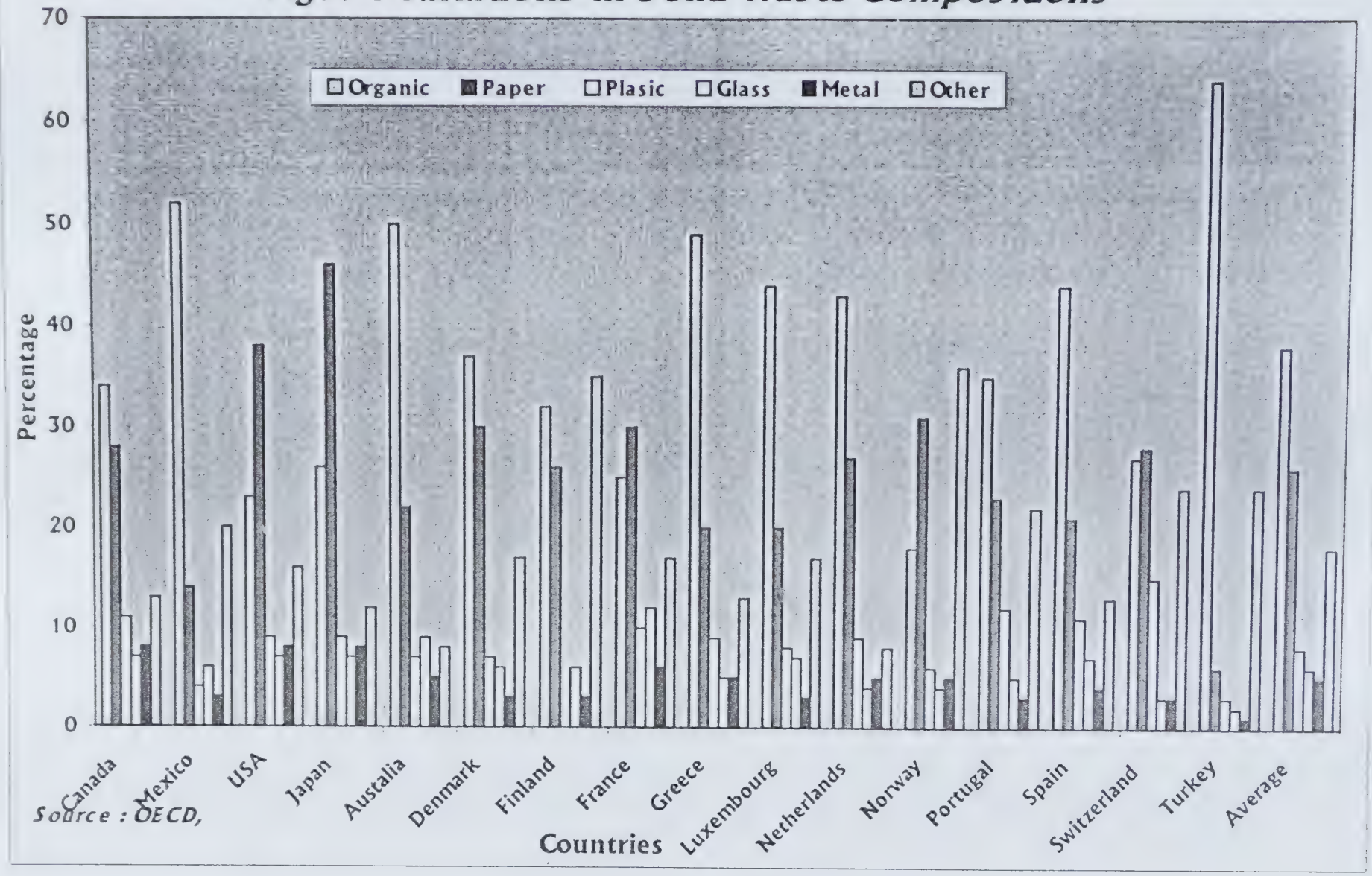


Fig. : 3 Per Capita Solid Waste Generation in Developed Nations



Source : OECD, 1995, World Bank,

Fig. : 4 Variations in Solid Waste Compositions



Source : OECD,

3.1.5. NOISE POLLUTION*

Introduction

Sound is essentially known as variations in pressure, stress, particle displacement, particle velocity propagated in an elastic medium. But from the ordinary viewpoint of hearing and to most of us it is simply anything that we hear. Noise is generally thought of as unpleasant or unwanted sound. Noise may or may not be harmful to hearing depending on its character and the conditions of exposure.

Noise can disturb man's work, rest, sleep and communication; it can damage his hearing and evoke other psychological, physiological and possibly pathological reactions. However, environmental factors and the adverse health effects of noise do not lend themselves to a straightforward analysis.

The Growth of the Problem

Auditory damage from excessive noise was known hundreds of years ago. Nevertheless, before the Industrial Revolution, comparatively few people were exposed to excessive noise. The position changed rapidly with the advent of power-driven machinery. Today, noise has become omnipresent. Those exposed by virtue of their work, apart from employee in heavy industry (iron and steel, refinery, textile mill, chemical plants, mining, saw mill, etc.), include farmers, some office staff, and numerous categories of building and transport workers (rail, road and air), many men and women engaged in secondary industries, certain research and university personnel and members of the armed forces. The number of workers engaged in some major group of industry is given below:

Major Group	Number of persons
Textile	10,00,000
Oil and Natural gas	55,000
Mining	10,07,000
Construction	54,00,000
Manufacturing	34,59,000
Total	**109,21,000**

* Dr. S.K. Bhattacharya, Deputy Director (Sr. Grade), NIOH, Ahmedabad

Out of nearly 11 million work force, 30-40% of the workers are expected to be working in noisy workplaces. The global scenario suggests from assumed disease rate calculation that per million population, noise induced hearing loss was detected in 185 persons in the age range of 15-44 years, 2016 persons in the age range of 45-59 years, 2016 persons in the age range of 45-59 years and 587 persons in the age range of 60+ years.

Apart from industrial sources exposure to noise from domestic sources such as desert cooler, diesel generators, washing machines etc. can also produce adverse health consequences. Further, use of loud speakers during night or early morning hours can produce sleep disturbances, irritation etc.

The Cost of Noise

The potential cost of noise-induced hearing loss to industry is greater than for any other occupational disease. In considering cost one must think in terms of hearing impairment, worker's compensation, reduced output, increased accident rates, communication difficulties, etc.

Summary of recommended noise exposure limits

As per WHO (1980), the equivalent continuous A-weighted sound pressure level Leq is recommended for use as a common measure of noise exposure. The measurement period should be related to the problem under study, for example in the case of occupational noise, Leq (8-h) would be measured for a complete 8-h shift.

For the working environment, there is no identifiable risk of hearing damage in noise levels of less than 75 dBA Leq (8-h). The term dBA denotes the unit of measurement of noise in decibels on A-weighted scale. For higher levels,

there is an increasing predictable risk and this must be taken into account when setting occupational noise standards.

In other occupational and domestic environments, acceptable noise levels can be established on the basis of speech communication criteria. For good speech intelligibility indoors, background noise levels of less than 45 dBA Leq are required.

At night, sleep disturbance is the main consideration and available data suggest a bedroom noise limit of 35 dBA Leq.

Data from surveys of community noise annoyance lead to the recommendation that general daytime outdoor noise levels of less than 55 dBA Leq are desirable to prevent any significant community annoyance. This is consistent with the speech communication requirement given above. At night, a lower level is desirable to meet sleep criteria; depending upon local housing conditions and other factors this would be in the order of 45 dBA Leq.

To reduce occupational exposure to noise, acts, codes, limits and standards have also been evolved in various countries. There is a general obligation for an employer to provide a workplace, which is safe and healthy. In 1972, the Department of Employment in U.K. issued a code of practice for reducing exposure of employees to noise. It lays down the maximum level of noise exposure (equivalent continuous noise level-Leq) for an eight-hour working day to be 90 dBA. On an assumption that the working life time in injurious noise will be 30 years it can be stated that an equivalent continuous noise level of 90 dBA should not be exceeded habitually (8 h/day, 5 days a week and 48 weeks/year) without hearing protection. The International Organization for Standardization (ISO 1971) has also considered the safe limit of exposure to noise as 90 dBA.

In India, by and large, the international standard for safety from occupational noise exposure (ISO 1999, 1971) is considered Table-1. Noise induced

hearing loss has also been incorporated in the Factories Act (1976) as a notifiable disease and also made compensable.

Indian Standards

Indian Standards for acceptable indoor and outdoor noise levels are given in Annexure – I.

AVAILABLE DATABASE

- **Industrial Noise**

Textile Industry

The noise in textile industries is loud and continuous. In the weaving shed sound pressure level (SPL) ranged from 102-114 dB, the higher value of the range being measured in a more clean weaving shed which has glazed tiles fitted on its walls.

Drugs and Pharmaceutical Industry

A drug and pharmaceutical firm engaged in the manufacture of vaccines and various other drugs through a fermentation plant along with two auxiliary units, air compressor and ammonia compressor, is also producing noise at alarming proportions. The measured sound pressure levels were much in excess of the standard SPL of 90 dB for eight hour exposure daily with the SPLs ranging from 100-108 dB in the fermentation plant, 95-103 dB in the air-compressor unit, 93-98 dB in the ammonia compressor unit and 104-109 dB in the primary air filter.

Compressor House and Bottling Liquid Petroleum Workshops

At the inception stage of a compressor house of a large public sector undertaking of oil and natural gas, studies of noise problem ascertained the levels and analyzed the characteristics of noise originating from the compressors, that are harmful to the hearing and safety of the workers. It was observed that the SPLs ranged between 90-101 dB at various locations of the first floor and 91-108 dB on the ground floor thereby exceeding the

recommended safety limit. The high frequency content of the noise was alarmingly high compared to that of the potentially less damaging low frequency and crossed the boundary of the safe exposure limit, indicating a potential health hazard to the workers.

Transport Workshop

The sound produced in transport workshop was mainly due to hammering drilling, welding, moulding of steel sheets, etc. The peak SPLs were measured to be 80 and 90 dBA, varying widely over all the frequency bands from 250 to 8000 Hz.

Fertilizer Plant

In this plant the sound pressure levels ranged between 90 dBA and 100 dBA at the ammonia urea compressor plant and 100 to 104 dBA at the ammonia-urea-cooling tower.

Synthetic Yarn Manufacturing Unit

In this unit the noise was contributed by the Diesel Power ouse; installed for power supply to the various units of the establishment. The SPLs ranged between 97 and 117 dBA with most of the values being over 109 dBA, which is harmful to health and safety.

- **Community Noise**

Surface Rail Noise

The Indian railways, the second largest railway system in the world, operates nearly 7,800 passenger services a day to move about 11 million people over a route length of 62,300 km. There are many sources of noise in the railway, which appear apparently harmless but have the potential to assault man. A study on the surface railway revealed that the platform noise ranged between 71-72 dB in the morning and 77-83 dB in the evening which was high compared to the recommended limit for daytime noise exposure of 55 dB and could produce irritation and annoyance in the employees. The noise from the

loud speakers mounted in the platform ranged between 87-90 dB and the movement of trollies produced noise at similar levels. The whistle noise at a distance of 1m from the engine ranged from 105-108 dB for the electric engine, upto 110 dB for diesel engines and 115-119 dB for steam engines. The exhaust noise ranged from 90-95 dB for diesel engines and 111-118 dB for steam engines.

Underground Rail Noise

As a viable and economically sustainable alternative to the surface rail, a mass rapid underground tube railway system has been constructed recently, yet the hostile noise environment appeared to dominate the platform and also the interior of the train coaches due to wheel-rail interaction during train arrival and departure, ventilation system, public address system, train whistle and the crowd. A study undertaken by the NIOH, Ahmedabad made startling revelations. The sound pressure levels (SPL) on the platforms during peak hours (0800-1130 h and 1600-2000 h) ranged between 80-82 dB. Arrival of the train in the platform pushed the SPLs in the range of 84-87 dB, while during departure the SPLs were still higher, ranging between 89-93 dB. The SPL of 95 dB was registered for a passing train.

Road Traffic Noise

Road traffic noise is also not an exception in causing problems of noise pollution. The most congested city areas in Ahmedabad like Kalupur Station area, Pankore Naka and Teen Darwaja had SPL upto 102 dB compared to the less congested areas like Gujarat University, Law Garden and Navrangpura where SPLs were upto 70 dB. However, the SPLs were high compared to the permitted day time noise of 55 dB and night time noise of 45 dB. This noise can cause in the general public hypertension, speech intelligibility and also produce annoyance and sleeplessness, which in turn can lead to indigestion.

Aircraft Noise

A short survey revealed that aircraft produced a high level of noise during departure operations with the SPL ranges being 97-109 dB for Airbus 300, 98-109 dB for Boeings 747 and 737, and 96-112 dB for Tristar. During touch down at an angle of 30^0 with the runway these aircraft produced SPL of upto 108 dB and during take off 100 dB at night or early morning. This can pose a threat to health of the airport ground staff and also to those living near the airport.

Noise levels originating from various sources have been summarized in Table-1.

- **Noise levels in cities**

Studies carried out on noise pollution have revealed that average ambient noise levels in residential commercial and sensitive areas of Calcutta, Mumbai, Jaipur, Bangalore, Chennai, Kanpur and Hyderabad both during day and night time were above the prescribed standards. Highest levels of noise were recorded at Calcutta and noise levels in industrial areas were below the prescribed standards except in few areas in some cities. The ambient noise levels as recorded in various cities are given in Table-3.

- **Health Effects**

Hearing Loss

It has been observed that 50% of the noise exposed workers in an ammunition factory suffered hearing loss as against 12% of the control group. Also 22% workers exposed to noise showed early noise induced hearing loss with a most characteristic dip at 4000 Hz. Further 62% of 1398 artillery personnel exposed to noise of various military vehicles suffered hearing loss. In a nitric acid plant, hearing loss was observed in 51% of the noise exposed group. Hearing acuity of textile weavers aged 25-39 years, exposed to a noise level of 102-104 dBA was found to be poor. Noise induced hearing loss (NIHL) at 4000 Hz. was as high as 30 dB in the age range 25-29 years, 40 dB

in the age range 30-34 years and 45 dB in the age range 35-39 years. The NIHL at 4000 Hz. is known to be irreversible.

Behavioral Effects

Exposure of workers to noise levels of 90-119 dBA was also found to result in sleep disorders, mental fatigue, annoyance and reduced alertness. The speed of task performance was impaired significantly by noise. Adverse effects of noise were observed in tweezer dexterity with higher degree of degradation observed at moderately different levels of the task. Similar observation was also noticeable in two hand coordination. Reaction time was enhanced under high noise condition. Certain physiological measures (oral temperature, pulse rate and skin temperature) were also found to be high in workers engaged at high noise condition.

Production Efficiency

The production data of each weaver collected for at least 15 days after the weavers were found to have had worn hearing protection devices (ear plug and ear muff) for 30 successive days was examined. The results showed that the production of the weavers wearing ear-muffs aided with ear plugs was significantly higher than the other weavers. The findings thus suggest that the weavers with hearing protection devices had an increased rate of production, parallel to the increasing degree of protection from noise rendered by the protective devices.

Ambient Noise Impact Assessment for Residential Community

Value function curves for noise impact assessment based on literature review, questionnaire surveys and interviews with experts have been developed to evaluate the impacts of noise in a coal mining residential complex in North Karanpura area of Central Coalfields Ltd. Based on two questionnaire surveys to get expert views, the ranking and relative weightages of five important impacts of noise exposure were established. The relation between these

parameters and NEQ (Noise Environmental Quality) value were evaluated through research findings, and value function curves for each parameter were developed through the statistical package for social sciences. The NEQ(R) (resultant NEQ) was evaluated for the residential, commercial, and sensitive areas of the coal mining complex. All the residential colonies fell in the `good' or `excellent' category (NEQ-R ranges from 0.70 to 0.87). However, only four colonies (out of eight) fulfilled the desired NEQ(R) (0.81). The Central School locality and Regional Hospital surrounding presented `good' gradation, one step below the desired `excellent' gradation. Hence, there is a need to improve the noise environment in the residential complexes of the coalfield so that they comply with the suggested minimum gradation system.

- **Multiple Stress Effects**

Interaction Effects

Noise and Heat:

The interaction effects of noise and heat on neuromotor based functions were studied in acoustic chamber. The combined effects of heat (35°C) and noise (100 dB) caused higher error rate in card sorting (face value) and decreased accuracy in reasoning ability.

Noise and Illumination

The interaction effect of noise and illumination on performance efficiency examined under six experimental conditions of three levels of illumination (50, 150 and 300 lx) and two levels of noise (70 and 100dB) revealed significant slowing of response rate in letter cancellation test in noise condition of 100 dB and a progressive improvement with the gradual rise of illumination level. The combined effect of noise and illumination on the accuracy scores reflected performance decrement under high illumination level (300lx) and under high noise condition (100 dB). The rate of decline in the accuracy and efficiency of performance in hand precision test under high illumination level was

significantly more pronounced under noise condition than in the quiet condition (70 dB).

- **Intervention**

Testing of Hearing Protection Devices

Attenuation Characteristics

Experimental studies on the assessment of attenuation characteristics and comfort levels of a variety of ear plugs and ear muffs have also been carried out by NIOH. The attenuation characteristics of two models of ear plugs (A and B) and five models of ear muffs (A,B,C,D&E) were assessed in the acoustic chamber. The results showed that both models of ear plugs yielded low attenuation values of 9-11 dB at frequencies 2000-8000 Hz. The ear muff (Model E) afforded maximum sound attenuation (35-40 dB) at frequencies 3000-8000 Hz. The attenuation values of other ear muffs were relatively low ranging 28-32 dB for model 'A', 26-30 dB for model 'B', 32-35 dB for model 'C' and 15-20 dB for model 'D'.

Comfort Assessment

Absolute impression of comfort – uncomfortable sensation (Psycho-physical method) produced by the wearing of ear protectors revealed high percentage of comfort responses for ear muff model 'E' due to its overall low application force and specially smaller application fore of its headband spring compared to those of the other ear muffs. Model 'A' and 'B' were graded as less comfortable compared to model 'E' because the application force of these two models was comparatively high as were the tightness of the headbands. Model 'C' was rated as less comfortable and model 'D' as least comfortable, despite low application force and less tightness of the spring. Thus the five models of ear - muff were graded for comfort in wear.

Legislative Control of Noise

The drastic remedy for noise control is prohibition. Beyond a certain point, the community may have to decide that a certain noise is intolerable and must be prohibited at any cost. Some legislative activation is initiated in India.

Steps taken for Noise Pollution Control
(Ministry of Environment & Forests)

- Ambient noise standards in respect of industrial, commercial, residential areas and silence zone have been notified under the Environment (Protection), 1986.
- Standards have also been notified for automobiles, house hold appliances, DG sets and construction equipment at the time of manufacturing stage itself.
- Code of practice for controlling noise pollution from public address system, air craft operations, railway operations, constructions activities and bursting of crackers have been evolved by Central Pollution Control Board as guideline to control noise pollution.
- Noise level surveys have been conducted in various cities and towns.
- Noise standards for large Diesel Generator Sets (15-500 KVA) have been notified in January, 1999.
- Guidelines have been evolved for use of loud speaker/public address system.

Anyone violating the Act and Rules is liable for severe punishment, fine up to Rs. 1,00,000/- and/or imprisonment up to 5 years.

Further the Bombay High Court, the Calcutta High Court and the Karnataka High Court have taken a very series view of noise pollution due to loud speakers, fire crackers, beating of drums and use of musical instruments during road side processions etc.

The Mumbai High Court by its order of 1995 has directed the Maharashtra Government and Mumbai Police not to allow use of loud speaker that would

cause noise pollution and highlight the EP Act 1986 and the Rules of noise 1989. The time limit prescribed in EP Act is upto 9.00 PM only.

The Calcutta High Court has firstly ordered in April 1996 stating that loud speaker should not be allowed to operate in the street between 9.00 PM in the evening and 7.00 AM in the morning for any purpose at any time including for the purpose of advertisement of any entertainment, trade or business.

The Karnataka High Court directed the Bangalore Police Commissioner to act against commercial establishments, social and religious bodies, shops and the likes which cause noise pollution so infringing upon the **right of citizens, particularly sick persons, students and old people.**

Order of High Court of Judicature at Bombay Writ petition No. 180 of 1998

Considering the aforesaid contention and the petitioner's grievances, the Commissioner of Police is Directed to publish notice in newspapers that nobody is permitted to use loud speaker after 10.00 p.m. and that whosoever commits breach of the permission would be prosecuted in accordance with Law. Even upto 10.00 p.m. the loudspeaker would be tuned at a reasonably low decibel. The Deputy Commissioner of Police of the particular zone would be responsible for enforcing these directions.

10th five year plan

- **New Emerging issues**

- Creating awareness regarding wearing of hearing protectors for prevention of noise induced hearing loss in industrial workers need to be strengthened as an integral part of health and safety programme.
- Pre-placement audiometry and periodic annual follow up should be incorporated in those seeking employment.

- Legislative control of exposure to occupational noise must be enacted.

➢ **Researchable issues**

- Long term health effects due to high level industrial noise and lower level general environmental noise must be identified.
- Longitudinal studies on young people over many years prior to, and during, occupational noise exposure should be considered to find out hearing acuity changes during adolescence and to obtain data on the progressive effect of noise on the "normal" hearing level of the population.
- Development of sensitive hearing tests for early detection of hearing loss and also to evaluate the problem of individual susceptibility should be made.
- Longitudinal studies of communities exposed to major changes in their noise environments should be conducted to refine existing dose-response (noise-annoyance) relationships and to include the effects of adaptation and societal changes on public reaction to noise.
- Development of mathematical model for prediction of efficiency of hearing protectors should be attempted.

Intersectoral Involvement

- Ministry Health and Family Welfare, Ministry of Labour, Ministry of Environment and Forest and Ministry of Urban Development
- Central Pollution Control Board
- NIOH, CLI, IITs, Central Road Research Institute

Recommendations

- Periodical Noise monitoring should be done.
- Legislative Control of Noise should be enacted by all State Governments and the Central Government as well.
- Safe limit of exposure to industrial noise should be enacted and enforced.
- If it is not possible by environmental control to reduce noise to sufficiently safe level, it should be mandatory for the workers to wear hearing protectors in noisy work places.
- In Indian airports flights landing and taking off should not be allowed between midnight and dawn, otherwise sleep disturbance will take place in the people of the vicinity of the airport.
- Punitive actions should be taken against offenders of noise pollution norms.

Annexure – I : ACCEPTABLE NOISE LEVELS (IS 4954 – 1968)

Acceptable outdoor noise levels in residential areas		Acceptable indoor noise levels for various types of buildings	
Location	**Noise level (dBA)**	**Location**	**Noise level (dBA)**
Rural	25-35	Radio & TV studio	25-30
Suburban	30-40	Music room	30-35
Residential (urban)	35-45	Hospitals, class room, auditoria	35-40
Urban (residential and business)	40-50	Apartments, hotels, homes, conference rooms, small offices	35-40
City	45-55	Court room, private office, libraries	40-45
Industrial area	50-60	Large public offices, banks, stores, etc.	45-50
		Restaurants	50-55

Table – I

Noise Exposure Limits (ISO 1971)

Exposure duration (hours per day)	Maximum Sound Level (dBA)
16	87
8	90
4	93
2	96
1	99
½	102
¼	105
And so on	

TABLE-2 : NOISE LEVEL SURVEY

Type of Industry	Noise levels (dBA)
Textile	102-114
Power plant	85-90
ONGC (Drilling)	90-119
Fertilizer plant	90-102
Road Traffic (Ahmedabad city)	60-102
Surface rail traffic	91-102
Metro rail	70-111
Whistle of the train	106-109
Air traffic	
Air bus 300	95-109
Boeing 747	98-107
Trister	96-112

TABLE-3 : AMBIENT NOISE LEVELS (dB) IN CITIES

Cities	Residential		Commercial		Sensitive		Industrial	
	Day	*Night*	*Day*	*Night*	*Day*	*Night*	*Day*	*Night*
Bhopal	60	44	75	57	73	42	68	47
Bangalore	59-75	37-59	68-81	46-64	58-74	--	63-86	42-65
Calcutta	76-86	58-76	70-90	57-78	69-89	65-70	75-82	53-70
Chennai	57-84	45-50	74-80	69-71	46-70	47-50	69-76	63-69
Delhi	53-71	--	63-75	--	62-68	--	65-81	--
Dehradun	50	38	70	50	58	42	50	45
Hyderabad	56-73	40-50	67-84	58-73	62-78	51-67	44-77	42-70
Jaipur	46-82	43-78	64-88	51-80	60-75	55-66	59-81	48-78
Kanpur	49-69	39-59	68-82	57-76	47-61	35-57	63-78	57-63
Kochi	70	51	85	56	72	51	70	61
Lucknow	55	50	70	58	50	40	60	58
Mumbai	45-81	45-68	63-81	60-75	58-77	46-66	73-79	56-72
Varanasi	50	40	70	50	55	40	50	50
Vizag	74	59	85	70	75	57	75	51

3.1.6 VECTOR BORNE DISEASES*

Preamble

In infectious disease epidemiology vector is defined as an arthropod or any living carrier that transports an infectious agent to a susceptible individual. The diseases occurring through vectors are known as vector borne diseases or arthropod borne diseases. Vector-borne diseases constitute a major health problem in India. Not only the vector borne diseases are on upsurge but also there is re-emergence of vector borne diseases. For example plague which became silent and was considered as a candidate disease for eradication reemerged after 28 years in 1994 in India. The available database suggest that this upsurge and resurgence of the vector borne diseases is due to the gross mismanagement of environment which influence vector borne diseases directly by modifying the behavior and geographical distribution of vectors.

Available database

Malaria

At present about 100 countries in the world are considered malarious. The incidence of malaria worldwide is estimated to be 300-500 million clinical cases each year and annual mortality due to it is 1.1-2.7 million. In India though a remarkable progress was made in control of malaria till 1984 when malaria cases dropped down from 6.74 million cases in 1976 to 2.1 million cases, not much improvement has been noticed thereafter and malaria still continues to be a serious disease in India as 20,000 people and an estimated 577,000 DALYs(disability-adjusted life years) were lost due to malaria in 1998. Moreover, the proportion of falciparum malaria has increased to 34.82%. According to NAMP, in 1999, 2.3million blood smear positive cases of malaria and 1048 deaths due to malaria were reported. However, the falciparum malaria contributed to a significant proportion with a slide falciparum rate of 1.29 and Plasmodium falciparum percentage of 49.96%.

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* Dr. R.R. Tiwari, Research Officer, Dr. Raj Narain, Research Officer, NIOH, Ahmedabad and Dr. Balaraman, VCRC, Pondicherry

Filaria

Lymphatic filariasis, another important vector borne disease in India, is increasing every year due to gross mismanagement of environment. Present estimates indicate that about 420 million people are living in urban areas where filariasis is endemic. There are estimated to be at least 6 million attacks of acute filarial disease per year, and at least 45 million persons currently have one or more chronic filarial lesions.

Dengue syndrome

In India, a large number of cases regularly occur in urban, suburban and rural areas, with increasing proportion of Dengue Haemorrhagic Fever (DHF) and dengue shock syndrome. During the August to December 1996 outbreak in New Delhi, 10,000 cases of DHF and 400 deaths were reported, while 3064 DHF cases and 60 deaths were reported from Haryana, Punjab, Uttar Pradesh, Karnataka, Maharashtra and Tamil Nadu.

Japanese encephalitis (JE)

In the last decade, there has been a major upsurge of JE in Assam, Andhra Pradesh, Bihar, Goa, Karnataka, Manipur, Maharashtra, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, Pondicherry and West Bengal. In 1999, up to the month of October about 1471 cases and 287 deaths were reported.

Others

Other vector borne diseases of importance in India include plague, rickettsial diseases, guinea worm infestation, trachoma, kala azar and scabies. Plague which was brought under control by 1966 when the last case was reported, again reappeared in 1994 when out of 4780 suspected cases 167 tested positive for plague and 53 died of it. Similarly, about 5 million people are estimated to be living in guinea worm disease endemic areas while scabies is more evident among the rural population.

The presence of vector for a disease does not imply disease occurrence. There are multiple factors, which influence the ability of vectors to transmit disease. One of the important factors is suitable environmental factors, which is related to intense breeding and thereby greater density of the insect vector. This can be substantiated by the seasonal epidemics of certain diseases such as malaria. The environment changes that have occurred caused major changes in the vector and rodent populations, often increasing areas in which they breed and, consequently increasing the transmission of disease they carry. In rural areas, this environmental change has been caused due to large-scale water development projects and wide spread deforestation, while in urban areas particularly of tropical, developing countries, the environmental change have been largely due to rapid, unplanned urbanization due to influx into cities of migrant population from rural areas, seeking better jobs and economic development.

However, for convenience the factors responsible for the change in vector density and characteristics can be sub-divided into climatic and non-climatic.

Climatic factors

Temperature, precipitation, relative humidity, and wind are the four main climatic factors that affect transmission of vector borne diseases and upon which the predictions of the effects of climate change are based. For example in case of malaria, the amount of precipitation affects the amount of surface water within which the malaria vectors, i.e. different member of the *Anopheles* family can breed. Relative humidity limits vector survival, and strong winds hinder biting by *Anopheline* mosquitoes and also allow for the distribution of the vector further than its own short flight span. Changes in temperature, rainfall, and relative humidity due to anthropogenic climate change are expected to influence malaria directly by modifying the behavior and geographical distribution of malaria vectors and by changing the length of the life cycle of the parasite). Climate change is also expected to affect malaria

indirectly by changing ecological relationships that are important to the organisms involved in malaria transmission (the vector, parasite, and host). Examples of such indirect forces are deforestation and habitat changes due to climate change that may affect which species of *Anophelines* are able to survive.

Climatic factors in resurgence

The emergence of falciparum malaria in the desert regions of Rajasthan in 1994, an area which is not a falciparum predominant area, was attributed to the major ecological changes. The spread of irrigation projects has been recognised as a major cause for the spread and increase of malaria epidemics. In addition, the expansion of water-intensive crops has created conditions conducive to the spread of malaria. Irrigation was increased from 26.8 mh in 1951 to 76.6 mh in 1991. Deforestation has reduced forest cover from 40.48 mh in 1950 to 22.30 mh in 1991, rice paddy cultivation has increased from 30.81 mh in 1950 to 42.18 mh in 1991 and sugarcane acreage has increased from 1.71 mh in 1950 to 3.41 mh in 1991. This has created tremendous opportunities for the mosquito vectors to breed uninterruptedly and invade new regions, thus increasing the area of their distribution and also the duration of transmission.

Non-Climatic Factors

Industrialization

India has been becoming more industrialized, and with industrialization comes urbanization. Urban areas did not experience much malaria in India in the past and so no effort was put into controlling malaria in those areas. In the 1990s, however, due to an increase in industrial growth, many forest areas where malaria is endemic have been cleared and those areas developed. These areas become more easily accessed. Migration of non-immune people creates an environment for epidemics. An increasing urban population creates a large number of peri-urban areas on the outer limits of the city which now account for 25-40% of the Indian population. These areas are unplanned and

poor people live there in unsanitary conditions. This creates the right environment for epidemics caused by increases in An. culicifacies which breeds in clean water on the ground due to rain and An. stephensi which breeds in wells and stored water. An. stephensi has extended its distribution in India over the past four decades by entering more towns and peri-urban areas. This spread in An. Stephensi has been found to be related to the spread of piped water systems throughout the country. Peri-urban malaria is a new malaria paradigm because migrants often have chronic malaria and the poor environmental conditions in their temporary settlements foster mosquito breeding and malaria transmission.

Irrigation

Irrigation was introduced by the green revolution in some areas in order to increase agricultural productivity to feed the growing population. This irrigation was created by building a large number of dams and canals, which often caused seepage from canals and a rise in the water table, thus creating a source of still water in which malaria vectors could breed. Irrigation can increase the transmission season of malaria, and in some parts of India, irrigation has changed areas from epidemic to endemic malarious regions. Until the 1980's, there were no malaria epidemics in the Thar Desert despite significant rains at different times in the year since 1901. A study of malaria in the Thar desert found that increases in malaria were due to the "mismanagement of the widespread developmental activities of canal-based irrigation." Starting in 1928, many different canal projects were carried out in this area in order to stimulate agricultural production through increased irrigation. With more irrigation, more water-intensive crops were planted. Investigators observed that due to seepage from the canals, 8600 hectares were permanently inundated, 1000 hectares were converted to marshy land, there was a rise in the water table, and hydroponic weeds, the preferred breeding grounds of An. culicifacies, increased in number. The area used to be dominated by An. stephensi, which is a desert species,

Agricultural Practices

Some agricultural practices, such as rice farming, also created large areas of stagnant water that are suitable breeding grounds for malaria vectors. Rice fields in India provide breeding habitats for twenty Anopheline species. However, there are differing opinions about whether increases in rice cultivation area correlate with increases in malaria. Thus more research is needed in order to better understand the relationship between these two factors.

Deforestation

In 1950, India had 40.48 million hectares of forest and in 1991, only 22.3 million hectares were left. Forests are a reservoir of high levels of malaria in India where the majority of the people are from tribal groups that have lived there for a long time. Currently malaria in the forests of India is stable with high transmission, and accounts for 30% of all malaria cases in India. Most of these cases are caused by P. falciparum, which is growing increasingly more resistant to chloroquine and, in certain locations, to other anti-malarial drugs. Mostly tribal groups live in the forest and have developed herd immunity to malaria. Most of these populations are immune to malaria and therefore, even if a few people became infected, a large epidemic is not likely to occur. Deforestation of the area allows new vectors to invade the forest fringes, producing epidemics, especially in the non-tribal non-immune people who have moved to these areas because of the development projects that have caused the deforestation. Some forest areas in India also experience moderate levels of chloroquine resistant P. falciparum. A study comparing malaria in forested and deforested areas in the Mandla District in the state of Madhya Pradesh in central India found that the patterns of malaria in the two areas were very different. This supports the idea that changes in the ecology of an area can lead to changes in the malaria dynamics.

Emerging issues

- Large-scale resistance of disease vectors to the commonly use pesticides along with the resistance of parasites to routine drugs used for the treatment.
- Search for newer and effective alternative to DDT that is being banned for public health purpose in most of the countries.
- Emergence and re-emergence of new vector borne diseases and already controlled vector borne diseases.
- Development of more effective methodology to sustain the achievements made in the control of vector borne diseases.
- Integrated vector control using engineering, chemical, biological and genetic methods of vector control.

Intersectoral Co-ordination

- Indian Council of Medical Research- for research issues.
- Irrigation Department
- Ministry of Agriculture
- Public Works Department
- Ministry of Health- Central and state
- Ministry of Environment and Forest
- Others including voluntary organisations

Recommendations

- Health Impact Assessment of developmental project such as irrigation projects, canal projects, etc.
- Maintaining the integrity of ecosystems, such as forest habitat and wetlands.
- Planned urbanisation with the help of inter-sectoral co-ordination with checks against the development of peri-urban areas.
- A centralised organisation which will help guarantee that DDT is used for public-health purposes only and ensure that the necessary quantity of DDT for vector control will be so low that even if diverted, it will not be enough to pollute the environment should be established.
- Information, education and communication about vector borne diseases, its control and prevention should be made mandatory in schools and engineering institutions.

3.1.7. EMERGING AND RE-EMERGING INFECTIONS*

The prevailing poor environment Health and sanitary conditions has resulted in increase in prevalence of infectious diseases due to emergence of some newly identified and re-emergence of some other infectious diseases accounting for significant mortality and morbidity. WHO defines:-

Emerging infectious diseases are those infections the incidence of which in humans have either increased during the last 2 decades or threaten to increase in near future. It also refers to those diseases, which were previously easily controlled by antimicrobials but have now developed resistance to these drugs.

Reemerging infectious diseases are those that have reappeared after a significant decline in their incidence. Appearance of plague in an explosive form in 1994 after a period of quiescence of almost 27 years is an important example.

List of emerging infectious agents

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EXAMPLES OF PATHOGENS RECOGNIZED SINCE 1973

Year	Microbe	Disease
1973	Rotavirus	Major cause of infantile diarrhoea globally
1976	*Cryptosporidium parvum*	Acute and chronic diarrhoea
1977	Ebola virus	Ebola haemorrhagic fever
1977	*Legionella pneumophilia*	Legionnaires disease
1977	Hantaan virus	Haemorrhagic fever with renal syndrome
1977	*Campylobacter jejuni*	Enteric diseases distributed globally
1980	Human T-lymphotropic virus 1 (HTLV-1)	T-cell lymphoma-leukemia
1981	Toxin producing strains of *Staphylococcus aureus*	Toxic shock syndrome
1982	*Escherichia coli* O157:H7	Haemorrhagic colitis; haemolytic uraemic syndrome
1982	HTLV-II	Hairy cell leukemia
1982	*Borrelia burgdorferi*	Lyme disease
1983	HIV	AIDS
1983	*Helicobacter pylori*	Peptic ulcer disease
1988	Hepatitis E	Enterically transmitted non-A, non-B hepatitis
1990	Guanarito virus	Venezuelan haemorrhagic fever
1991	*Encephalitozzon hellem*	Conjunctivitis, disseminated disease
1992	*Vibrio cholerae* O139	New strain associated with epidemic cholera
Year	**Microbe**	**Disease**
1992	*Bartonella henselae*	Cat-scratch disease; bacillary angiomatosis
1994	Sabia virus	Brazilian haemorrhagic fever
1995	Hepatitis G virus	Parenterally transmitted non-A, non B hepatitis
1995	Human herpesvirus-8	Associated with Kaposi sarcoma in AIDS patients
1996	TSE causing agent	New Variant Creutzfeldt-Jakob disease
1997	Avian Influenza [Type A (H5N1)]	Influenza
1999	Nipah virus	Encephalitis

List of re-emerging infections

- Malaria
- Tuberculosis
- Plague

Factors responsible for emerging and re-emerging infections

- Illiteracy
- Ignorance
- Low socioeconomic status
- High population Growth
- Unplanned urbanization
- Poor environmental sanitation
- Natural Disasters
- Increased migration of population
- Growing international tourism and trade
- Droughts, floods and earthquakes
- Newer bio-pesticides
- Indoor air pollution

Available database

A comprehensive data bases on most of the emerging and re-emerging infections and the effect of environment on them is non-existent. This has resulted in their being no proper policy in our environmental planning and management of health problems arising out of environmental changes.

Several communicable diseases are endemic in India. An effective surveillance system is essential for planning, implementation and monitoring the disease control programmes. Many of these diseases have seasonal and cyclic trend, which can be discerned through the surveillance system. These diseases can also cause outbreaks with the potential to spread rapidly and cause many deaths. Outbreaks of new and re-emerging infections may also occur.

Ministry of Health & Family welfare, Government of India has launched the National Surveillance Programme for Communicable Diseases (NSPCD) in selected districts for detection of early warning signals of outbreaks and rapid response for prevention and control of these outbreaks and diseases

Researchable Areas

- Environmental epidemiological surveillance on polluted areas
- Identification of emerging and re-emerging pathogens
- Identifying reservoirs sustaining transmission.
- Molecular epidemiology for identifying new genotypes
- Monitoring impact of immunization programme in re-emergence of infections
- Industrial epidemiology

Legislation

There is no comprehensive legislation on environment and health. Some of the existing legislation only address to the concerned environmental related areas and so also health separately even these regulations are neither nor implemented properly. Some of existing legislation on health related issues are :

- Drugs and Cosmetics act 1940
- Prevention of Food Adulteration Act 1955
- National Health Policy for Achieving HFA 2000
- A Model Public Health Bill 1978
- Regulation on Hospital Infection Control and Waste Management.

Recommendations

- Establish early warning signals for detection of disease outbreaks
- Capacity building at district , regional , state and national levels and strengthening of linkages for disease surveillance from peripheral to central levels
- Networking of various institutions and electronic communication
- Strengthening and modernization of laboratories for detection of microbes
- Establish database of Epidemic prone diseases
- Rapid communication and appropriate response for prevention and control of outbreaks of infectious diseases
- Training of personnel

3.1.8 INDOOR AIR POLLUTION FROM THE USE OF BIOMASS FUELS*

Preamble:

In many people's minds air pollution is associated with the contamination of urban air from the automobile exhaust and industrial effluents. However, in developing countries, the problem of indoor air pollution far outweighs the ambient air pollution. There are four principal sources of pollutants of indoor air : (a) combustion (b) building material (c) the ground under the building and (d) bio-aerosols. In developed countries most important indoor air pollutants are radon, asbestos, volatile organic compounds, pesticides, heavy metals, animal dander, mites, molds and environmental tobacco smoke. However, in developing countries the most important indoor air pollutants are the combustion product of unprocessed solid biomass fuels used by the poor urban and rural folk for cooking and heating. The 1991 National Census for the first time inquired about the use of fuel used for cooking. It revealed that about 90% of the rural population relied upon the biomass fuels like animal dung, crop residue and wood. A small portion used coal. Nationwide about 78% of the population relied upon the biomass fuels and 3% on coal.

Available Database

- **Major air pollutants released from Biomass Combustion:**

It has been estimated that more than half of the world's house-holds cook their food on the unprocessed solid fuels that typically release at least 50 times more noxious pollutants than gaseous fuels (Smith K.R. (1990), Indoor air quality and the population transition. In. Kasuga H ed. Indoor Air Quality, Berlin: Springer Verlag, 448-456). The stoves or *chullah* used as cooking stove are not energy efficient. The fuels are not burnet completely. The incomplete combustion of biomass releases complex mixture of organic compounds, which includes suspended particulate matter, carbon monoxide, poly organic material (POM) and poly aromatic hydrocarbons (PAH), formaldehyde, etc. The biomass also may contain intrinsic contaminants such as sulphur, trace metals etc.

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A recent report of World Health Organization asserts "the rule of 1000" which states that a pollutant released indoor is one thousand times more likely to reach people's lung than a pollutant released outdoors (World Health Organization (1997) Health and Environment in Sustainable Development. Five Year assessment after Earth Summit, World Health Organization, Geneva). It has been estimated that about half a million women and children die each year from indoor air pollution in India. Compared to other countries, India has among the largest burden of disease due to the use of "dirty" household fuels. 28% of all deaths due to indoor air pollution in developing countries occur in India.

➢ Specific Diseases Attributed to Indoor Air Pollutant Exposure:

Respiratory illness, cancer, tuberculosis, perinatal outcomes including low birth weight and eye diseases are the morbidities associated with indoor air pollution.

Respiratory Illness:

Acute lower respiratory infections (ARI):

Acute respiratory infections are the single most important cause of mortality in children aged under 5 years, accounting for around 3-5 million deaths annually in this age group *(Stansfield S., Shepherd D. Acute respiratory infection (1993) In: Jameson D., Mosle W.,Mesham A.,Bobadilla J eds. Disease control priorities in developing countries. Oxford. Oxford University Press. 67-90.)*. It has been estimated that ARI is the largest single disease category for India, accounting for about one-eighth of the national burden. For the world as a whole, ARI is also the largest category, accounting for about 8.5% of the global burden. Astonishingly, Indian ARI is actually the largest single disease category in the world, in the sense of being subject to attention by one government. The Indian portion of this one disease class, which affects mainly one age group, accounts for 2.5% of the entire global burden of ill health. Although, the studies carried out elsewhere have been fairly consistent, two of the studies carried out in India

have failed to establish relationship between use of biomass fuels and ARI. (Shah et al. (1994) J Trop Pediat. 40: 201–206; Sharma et al (1998) Environ Health Perspect. 106: 291-297).

Chronic obstructive pulmonary disease and Chronic Cor pulmonale:

In developed countries, smoking is responsible for over 80% of cases of chronic bronchitis, i. e. inflammation of the lining of the bronchial tubes, and for most cases of emphysema (over inflation of the air sacs in the lungs) and chronic obstructive pulmonary disease (progressive and incompletely reversible airflow obstruction). Padmavati and her colleagues (Padmavati S, Pathak SN (1959) Circulation. 20: 343–352; Padmavati S and Joshi B. (1964) Diseases of the Chest. 46: 457–463.) Showed high incidence of chronic cor pulmonale in north India women. They attributed this to use of solid biomass fuels leading to chronic bronchitis and emphysema, which results in secondary cardiac problems known as chronic cor-pulmonale.

Pneumoconiosis:

Long term exposure to soot from domestic fuels can cause pneumoconiosis like disease. Among the population of Ladakh, in some villages using biomass fuel without any chimney, the prevalence of pneumoconiosis as high as 45% has been reported (Saiyed (1991) Br J Industr Med 48: 825-829.Norboo T (1991) Int J Epid. 20: 749–757.)

Lung Cancer:

At present there is limited evidence of indoor exposure from coal fires leading to lung cancer but there is no evidence for the biomass fuels. NIOH studies have shown significant mutagenic activities of smoke extract of the biomass fuels. Further investigations are needed to reach definite conclusions.

Pulmonary Tuberculosis:

The residents of the houses using biomass fuels have been shown to have higher risk of pulmonary tuberculosis (Mishra VK et al (1999) Intl J Infect Diseases, 3: 119–129; Gupta BN, Mathur N. (1997) Energy and Environment

Review, 13: 61–67.) However, there were weakness in theses studies. In the study of Mishra et al, the diagnosis was based on self reporting which should have resulted into false positive and false negative cases. Gupta and Mathur did not control for the confounding factors except for age.

Cataract:

During cooking particularly with the biomass fuels, the cook has to blow air into the fire from time to time especially when it is moist and smouldering. This brings her eyes very close to the fire and causes considerable exposure to the emanating smoke. In a hospital-based case-control study in Delhi the use of liquefied petroleum gas was associated with an adjusted odds ratio of 0.62 (0.4 –0.98) for cortical, nuclear and mixed, but not posterior subcapsular cataracts in comparison with the use of cow dung and wood (Mohan M et al (1989) Arch. of Ophthalm. 107: 670–676.). An analysis of over 170 000 people in India yielded an adjusted odds ratio for reported partial or complete blindness of 1.32 (1.16 – 1.50) in respect of persons using mainly biomass fuel compared with other fuels after adjusting for socioeconomic, housing and geographical variables, although there was a lack of information on smoking, nutritional state, and other factors that might have influenced the prevalence of cataract. It is believed that the toxins from biomass fuel smoke are absorbed systemically and accumulated into the lens resulting in its opacity. The growing evidence that environmental tobacco smoke causes cataracts is supportive.

Adverse Pregnancy Outcome:

Low birth weight (LBW) is an important public health problem in developing nations attributed mainly to under-nutrition in pregnant women. Low birth has serious consequences including increased possibility of death during infancy. Exposure to biomass has been shown to be associated with LBW in India and elsewhere.

Activities/Initiatives during 9th Plan:

(i) Stoves:

Ministry of Non-Conventional Energy Sources, Government of India, initiated a special programme called National Programme on Cook Stoves (NPIC) which was initiated in 1985-86. About 32 million stoves have been supplied.

(ii) Clean Fuels:

The relatively cleaner fuels like LPG and kerosene have been subsidized by the Government of India. This subsidy is for all. The Andhra Pradesh government introduced a scheme called "Deepam Scheme". Under this scheme the government subsidizes the cylinder deposit fees for the women from the households with the income below poverty line.

(iii) Traditional Fuels:

Ministry of Environment and Forests (MoE&F) introduced a scheme to make fuel woods available to rural poor through shrubs and bushes and bushes and through lops and tops from large trees.

(iv) Study of Health Impact:

Ministry of Health & Family Welfare (MoH&FW) has a study of health impact due to indoor air pollution.

Researchable Issues:

(i) Epidemiological studies of correlation between biomass fuels use and occurrence of various diseases supposedly related to indoor air pollution and estimation of actual disease burden from the indoor air pollution.

(ii) Mechanistic studies.

(iii) Improvement of stove design with respect to reduce the emissions and increase fuel efficiency and housing design to improve ventilation.

(iv) Production of cleaner fuels from traditional material e.g. from the dung, wood and crop residue.

(v) Study the causes of failure to popularize the use of clean

Suggested initiatives during Xth Plan

Intervention:

Now there is enough evidence to accept that indoor air pollution in India is responsible for high degree of morbidity and mortality warranting immediate steps for intervention. The intervention programme should consist of following components.

1. **Public Awareness:**

The first and the most important step in prevention of illnesses resulting from biomass fuels is to educate public, administrators and politicians to ensure their commitment. Promoting awareness of long term health effects on the part of users. This may lead to people finding ways of minimizing exposure through better kitchen management and infant protection.

2. **Change in Pattern of Fuels:**

The choice of fuel is mainly a matter of availability, affordability and habit. The gobar gas plant which uses biomass mainly dung has been successfully demonstrated to produce economically viable quantities of cooking gas and manure. Recently the Government of Andhra Pradesh has introduced a programme called "Deepam Scheme" to subsidize the cylinder deposit fee for women from households with incomes below poverty line to facilitate the switch from biomass to LPG. Such scheme will definitely encourage rural poor to use cleaner fuels. The use of solar energy for cooking is also recommended.

3. **Modification in Stove Design:**

Use of cleaner fuels should be the long term goal for the intervention. Till this goal is achieved, efforts should be made to modify the stoves to

make them fuel efficient and provide them with a mechanism (e.g. chimney) to remove pollutant from the indoor environment. Several designs of such stoves have been produced. However, they have not been accepted widely. Large scale acceptance of improved stove would require determined efforts. The most important barrier to new stove introduction are not technical but social.

4. Improvement in Ventilation:

In many parts of the country poor rural folk are provided with subsidized houses under various government/international agencies aided scheme. Ventilation in kitchen should be given due priority in the design of the houses. In existing houses measures such as putting a window above the cooking stove and providing cross ventilation through door may help in diluting the pollution load.

5. Multisectoral Approach:

Effective tackling of indoor air pollution requires collaboration and commitment between agencies responsible for health, energy, environment, housing and rural development.

*3.2. OCCUPATIONAL HEALTH – ORGANIZED & UNORGANIZED SECTOR

3.2.1. Occupational Health

Preamble:

According to 1991 Census Report, out of 816.2 million population of the country, 278.9 million consisted of working population. Everyday many of these workers come across various physical, chemical, biological and ergonomic hazards. Repeated exposure to such hazards leads to the development of occupational diseases. As a rule, all occupational diseases are preventable and most of them do not have any treatment. Prevention is therefore the only appropriate strategy to deal with them. Due to lack of awareness amongst doctors as well as workers, want of expertise and inadequate laboratory facilities essential to establish diagnosis, most of these diseases pass undiagnosed. The workers, particularly of the unorganized sector of industry do not have access to special health care facility essential for the diagnosis and management of the occupational diseases. Moreover the scope of the legal measures, such as Factories Act and Mines Act, to ensure occupational health and safety of the workers and ESI Act to provide health care to the workers including diagnosis and management of occupational diseases, is limited to organized sector of industry. The workers of unorganized sector are largely devoid of these provisions.

Negligence to occupational health and safety of the workers may result in invisible burden to the economy, which, in some cases, may be substantial. Ill health of the workers results in reduced production due to inefficiency of the workers and sickness absenteeism. Moreover, the workers have to be paid sickness benefits and compensation. There is also increased expenditure either on the part of the factory management or the Government to meet the

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medical expenses for treatment of minor and major work related morbidities. Further, it must be realized that most of the occupational diseases are incurable and, therefore, the best course of action in dealing with them is their prevention. The economic benefits and incurable nature of occupational diseases must be taken in to account while considering investment in occupational health and safety programmes.

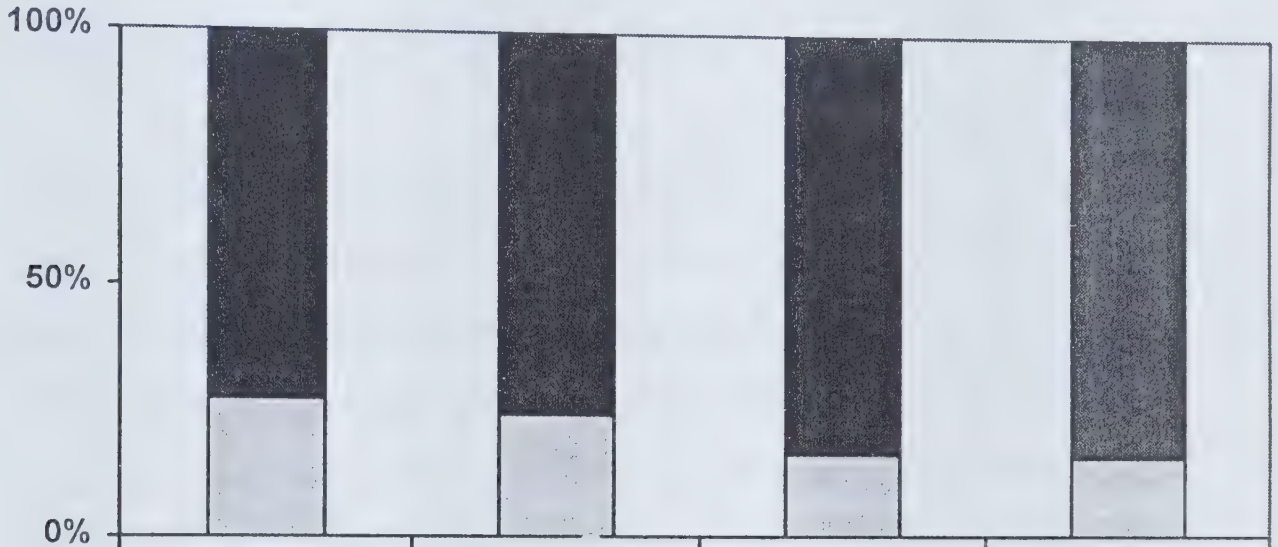
Available Database

- **Burden of Occupational Injuries and Diseases:**

Occupational factors make an important contribution to the global burden of disease. In addition to the misery of the worker and his/her family, morbidity and mortality results into economic burden to the society through decreased production from decreased efficiency, sickness absenteeism, higher labour turnover and loss of skilled manpower and cost of medical care. The estimated cost to the society in various studies in different parts of the world varied from 2 – 15% (Mikheev M. New epidemics: The challenges for international health work. In: New Epidemics in occupational health, Finnish Institute of Occupational Health, 1994; 27 –33.). A recent study by WHO (Leigh J, Macaskill P, Kuosma E and Mandryk J Global burden of disease and injuriy due to occupational factors. Epidemiology 1999; 10:626 – 631) estimate that approximately 100 million occupational injuries (1 lakh deaths) and 11 million occupational diseases resulting in 7 lakh deaths occur in the world each year. The report further states that, in India each year there are 17 million non-fatal and 45,000 fatal occupational injuries. Further analysis of the data show that about 37% of the occupational injuries in the world and 32% deaths due to these injuries occur in India. (Figure 1).

The WHO estimate also show that each year 924,000 to 1,902,300 cases of occupational disease occur of which 121,000 die during the year. Taking an average of the range, show that about 17% of the occupational diseases occurring in the world and 18% of the deaths due to occupational diseases,

take place in India (Figure 2). The investigators claim these estimates as most conservative. These figures for occupational injuries and occupational diseases are highest for any single country and surpasses even China having much larger work force.



	Occupational Injuries (Non Fatal) (in thousand)	Occupational Injuries (Fatal)	Occupational Diseases	Deaths due to Occupational Diseases
Rest of the World	45696000	141813	7125750	643950
India	17000000	45000	1413500	121000

Figure 2. Comparison of Annual Incidence of Occupational Injuries and Diseases in India and Rest of the World

Studies carried out by NIOH supports the above estimates for occupational diseases. For example the retrospective analysis of the data from four textile mills in Ahmedabad employing on average 1000 workers by NIOH *(Annual Report 1999-2000, National Institute of Occupational Health, Ahmedabad)* for occupational injuries for a period of two years revealed 3592 reported cases of non fatal injuries (necessitating two or more days away from work) i.e. an annual incidence of 449 cases/1000 workers/year. There are 1 million textile workers and therefore the total number of injuries in textile mill alone will be 449,000 cases. These reported cases do not include injuries not necessitating absence from the work for 2 or more days.

- **Economic Loss due to Occupational Injuries and Diseases:**

The adverse occupational factors have been estimated to cost 2 – 14% of the gross national products (GNP) for various countries. Incidence of occupation related morbidity and mortality are very high in India as shown by several studies. Even if we put a middle figure of 7% loss of GNP from occupational factors, and 1million crore Rs. GNP for the year 1999, the estimated cost will come to Rs. 70,000 crores each year.

The amount paid as compensation for death and disablement resulting from work related injuries in India has increased from mere Rs 8 million. in 1961 to Rs 186 million in 1997. During the same year there is decrease in the average number of workers in the establishments submitting returns from 4.77 million in 1961 to 2.67 million in 1997 *(Institute of Applied Manpower Research (2000) Manpower Profile India, Yearbook 2000, Gyan Publishing House, New Delhi.)* indicating underreporting.

- **Reliability of Data:**

Wide range in estimates of occupational diseases reflects the inherent problems in methodology for assessment. Work related acute injuries and diseases resulting from short-term exposure to high concentrations are easy to link with the cause, however, chronic diseases from long-term exposure are more likely to pass unnoticed. Moreover, occupational factors can lead to the onset of specific disease, e.g. pneumoconiosis, which could be directly related to the work, nevertheless, there are common disease e.g. low back pain, chronic obstructive lung diseases, psychosomatic diseases which could be caused or exacerbated by the occupational factors. The gross underreporting of occupational diseases can be illustrated from the following example. About 9 million workers belonging to various industries are covered under ESI Act 1948. According to annual report of ESIC for the 1995-96, 16,245 cases were compensated for all types of disability and only 25 cases were compensated for occupational diseases. Surveys by NIOH and other agencies have shown over 30% prevalence of byssinosis in workers of card room and blow room.

The prevalence of noise induced deafness was over 50% in weaving section. Both these conditions are compensable. Considering 1 million textile workers covered under the ESI Act, the number of compensable disease cases could run into several thousand. Thus there are inadequacies in primary reporting, collating, classifying and publishing data related to occupational injuries disease. The problem is further compounded by general lack of manpower trained in occupational medicine.

Advantages of Prevention of Occupational Diseases:

Occupational diseases and injuries are preventable and there is no room for complacence or defeatism. In addition to alleviation of suffering of workers and their families, the economic advantages of prevention of occupation related morbidity and mortality are obvious. It will result in the increased production from increased productivity of healthy workers, reduction in sickness absenteeism and retention of skilled labour. Moreover, there will be gross reduction in the cost of medical care.

9th Plan Programme and Activities:

Ongoing Activities: (Health Care of the Working Population:)

- **Employee's State Insurance Scheme:**

This scheme is mainly to provide special health care to the working population. For the diagnosis, treatment and compensation of occupational diseases, the ESI Corporation has started four special occupational diseases Centres at four metropolises, namely Delhi, Calcutta, Mumbai and Chennai. The programme covers only about 10 million workers out of total 285 million workforce. The quality of healthcare needs lot of improvement. Equipments like spirometer, audiometer etc., essential for the diagnosis of common occupational diseases are usually not available even in the hospitals. Due to introduction of mechanization and chemicals like fertilizers and pesticides the

occupational health problems of farmers have compounded. At present there is no mechanism to deal with the occupational health problems of several million workers of unorganized sector of industry.

There is need to increase the coverage of health care of the workers with emphasis on occupational health and improve the quality.

- **Prevention of occupational diseases and Protection of health of the Workers:**

Existing Mechanism of Occupational Health and Safety Regulation is summarized in tabular form in diagramme 1. Under the Factories Act, Mines Act, Workmen's Compensation Act and ESI Act there is legal provision to provide safety, protect health of the workers and to compensate for the occupational diseases.

- **Unorganized Sector of Industry:**

The above provision is only for the workers of organized sector of industry and mines and leaves over 90% of the work force uncovered. This work force consists of agricultural workers, self employed workers and workers of cottage and small industries. The working conditions are extremely hazardous in these places and the diseases occurring amongst the workers largely passes unnoticed. In highly hazardous small scale and cottage industries, the employment of children and women is very common. Several thousand children are employed in highly hazardous cottage industries like slate pencil industry of Mandsaur (M.P.), agate industry (Gujarat), Stone industry (all over the country), slate mines of Markapur (A.P.), fire cracks and match industry of Sivakashi (T.N.), carpet weaving industry of Northern India and Rajasthan, glass bangle industry of Firozabad (U.P.) etc. This is mainly because these industries are beyond the purview of regulatory mechanisms. The above list does not include the agricultural operations, which is responsible for the largest employment in the country.

- **Development of Human Resources:**

Directorate General Factory Advisory Services and Labor Institute (DGFASLI), Directorate General Mines Safety (DGFASLI) National Institute of Occupational Health (NIOH), All India Institute of Hygiene and Public Health (AIIH&P), Industrial Toxicology Research Centre (ITRC) and several university departments run short and long term courses for medial officers, industrial hygienists, safety officers, factory inspectors, mine inspectors, workers etc. These efforts of human resource development are inadequate.

- **Research & Development:**

NIOH, ITRC, DGFASLI, DGMS and several other organizations are engaged in generation of epidemiological data and basic laboratory research necessary for planning of strategy for prevention and control of occupational diseases.

New Initiatives during 9th Five Year Plan:

The Ministry of Health & Family Welfare, Govt. of India, identified occupational health as an important programme. The Ministry allocated Rs. 25 Crore for the treatment and control of occupational diseases. Following schemes were introduced during the plan. NIOH was identified as executing agency for the same.

- Prevention, control and treatment of silicosis and silico-tuberculosis in agate industry.
- Occupational health problems of tobacco harvesters and their prevention.
- Evaluation of occupational health problems of cycle pullers and redesign cycle rickshaw on ergonomic principal
- Child labour – Occupational health problems, evaluation and control
- Capacity building to promote research, education, training at NIOH

- Health risk assessment and development of intervention programme in cottage industries with high risk of silicosis
- Prevention and control of occupational health hazards among salt workers working in remote desert areas of Gujarat and Western Rajasthan.
- Hazardous processes and Chemicals: Database generation, Documentation and Information dissemination
- Health risk assessment of rural and urban population due to indoor/ambient air pollution.

NIOH and DG-FASLI organized several training and awareness programmes for the medial officers, industrial hygienists, safety officers, factory inspectors, mine inspectors, workers etc. These programmes were sponsored by World Health Organisation.

Suggested Programme Activities during Xth Plan:

In diagram 1 the existing mechanism for prevention and control of occupational diseases and injuries is shown. This mechanism pertains only to the organized sector of industries. The possible causes for the failure of this mechanism is shown in the diagram 2. To counter the shortfall in dealing with the occupational health problems, a recommended mechanism is summarized in table 1. This is probably the optimum approach in solving the occupational health problems of the workers of organized sector of industry at large and the members of unorganized sector of industry to some extent. To solve the occupational health problems of workers of unorganized sector of industry a special approach is needed.

Diagram 1. Existing Mechanism of Occupational Health and Safety Regulation

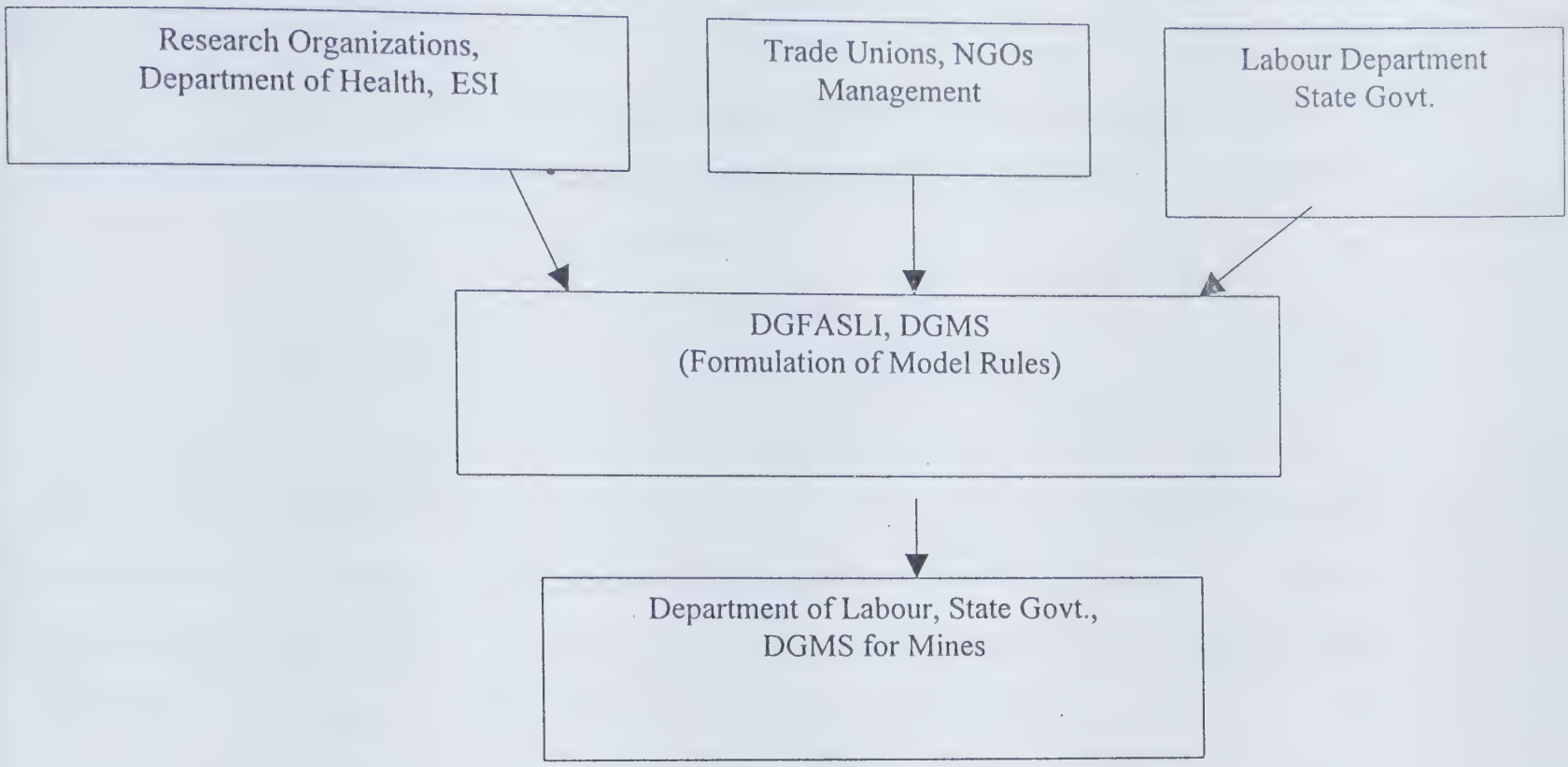


Diagram 2 Possible causes of Failure and Suggested Steps for the Effective Prevention and Control of Occupational Diseases

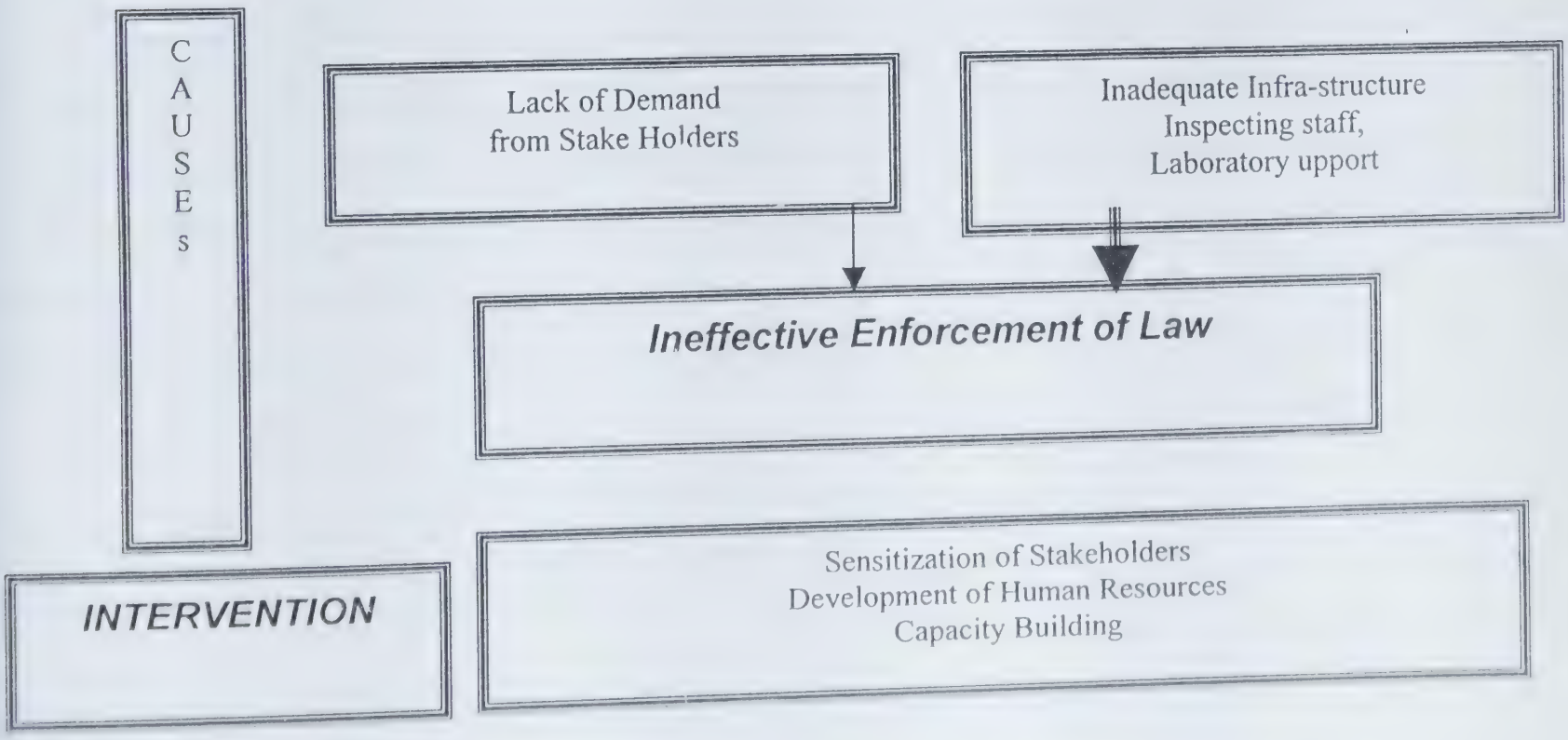


Table 1. Summary of the Actions Required for the Prevention and Control of occupational diseases in organized and unorganized sector of industry

Objectives	Action Required	Agencies
Identification of thrust area (Data generation)	1. Compilation of available information 2. Epidemiological surveys to identify new areas particularly in the unorganized sector of industry and the agricultural workers. 3. The medical officers should be encouraged to report to the Chief Inspector of Factories (CIF), the detection of occupational diseases particularly in informal sector.	National Institute of Occupational Health, Institute of Research in Medical Statistics (ICMR), National Informatic Centre, Industrial Toxicology Research Centre (ITRC), State health authorities, CIF. Central Labour Institute (CLI) All India Institute of Hygiene and Public Health (AIIH&PH), ESIS
Elimination/Control of hazards through engineering control	Development of appropriate technology for most hazardous jobs	National Environmental Engineering Research, CLI, Institute, NIOH, Owners of factories, Manufacturers of industrial machinery

Objectives	Action Required	Agencies
Optimum enforcement of Legislation	1. Development of manpower: Training of Factory Inspectors, Medical Inspectors and Laboratory Staff 2.Development/Strengthening of infrastructure facilities in industrial hygiene laboratories for sample	Department of Labour (State Govt.), CLI, NIOH, AIIH&PH.
To Develop biomarkers of exposure, effect and susceptibility	Laboratory studies involving molecular biology	NIOH, ITRC, University Departments.
To develop central facility for the analysis of toxic substances at nano gram level	Creation of an advanced reference laboratory having sophisticated equipments.	NIOH, ITRC, DG-FASLI, DGMS, University Departments.
Appropriate diagnosis and management of occupational diseases	1. Training of industrial medical officers, ESIS medical officers, doctors working in PHCs and District Hospitals. The emphasis should be for the detection of occupational diseases in unorganized sector. 2. Strengthening of laboratory and diagnostic facilities	NIOH, AIIH&PH, CLI, ITRC. State health authorities.

Objectives	Action Required	Agencies
Creation of awareness among workers, trade unions and management	Training and Education	NIOH, AIIH&PH, CLI, ITRC.
Legislation	The existing legislation for the health and safety of the workers should also be applicable to the informal sector.	Ministry of Labour.

3.2.2 AGROTECH AND ENVIRONMENT*

Problem identification

Environmental health risks cause nearly 20% of the burden of disease in the developing countries. Natural resources are under great pressure. About 20 countries primarily in Middle East and Africa are classified as water scarce or water stressed. Forests are disappearing at a rate of about 100,000 sq. km per year. Nearly 70% of old fisheries are over exploited. Soil degradation affects more than 900 million people in 100 countries and about 1.1 billion rural people are at risk from desertification and dry land degradation. Natural and man- induced disasters, which have often been front-page news in the last couple of years, have been maintaining their high frequency. Globally, disaster losses have increased from $71 billion in the 1960s to $608 billion in the 1990s.

The global environment outlook 2000 report of the United Nations Environment Programme provides a compelling assessment of the serious nature of the environmental threats faced by the international community. Environmental threats resulting from the accelerating trends of urbanization and the development of the mega cities; the tremendous risk of climate change; the fresh water crisis and its consequences for food security and the environment; the unsustainable exploitation and depletion of biological resources; drought; desertification and uncontrolled deforestation; increasing environmental emergencies; the risk to human health and environment from hazardous chemicals; and land based sources of pollution are all issues that need to be addressed.

Indian Agriculture

The advent of new technologies in agriculture has placed India in a comfortable position with an annual production of over 200 million tonnes of food grains which is nearly four times higher than food production in early 50s.

* Dr. H.C. Joshi, IARI, PUSA, New Delhi.

This became possible only because of the use of newer technologies and scientific methods of farming, in which development of high yielding crop varieties, expansion of irrigation networks and use of inorganic fertilizers and synthetic organic pesticides are prominent. However, this phenomenal growth in food production is not without its impact on environment. The rise in nitrate level in groundwater and ubiquitous presence of pesticide residues in food commodities are few examples of which now every one is aware. Therefore, at this juncture when we seem to be self sufficient in food production we can reformulate our priorities after critically evaluating the reasons for environmental degradation. Three major areas responsible for environmental degradation due to agriculture can be identified as i) New crop varieties and increased nutrient requirements. ii) Use of pesticides in agriculture iii) Lacunae in our present water and soil resource management practices. Apart from reformulating our policies on the above three problem areas there is also need for looking into the possibilities of introducing use of municipal and industrial wastes in agriculture and popularizing organic farming.

Over the years, the fertilizer consumption in the country has increased from 0.1 million tons in 1950 to about 18 million tons by the end of 2000.

Available Database

(a) New crop varieties and increased nutrient requirements

Development of high yielding crop varieties triggered the process of green revolution. The commendable progress made in this area has been applauded worldwide. These varieties required better irrigation facilities and significantly enhanced application of fertilizers, which resulted in tremendous growth of this sector. The increase in food grain production is mainly attributed to the higher fertilizer use. Over the years, the fertilizer consumption in the country has increased from o.1 million tons in 1950 to about 18 million tons by the end of 2000. The steep hike in fertilizer consumption during the period 1965-1984 was mainly attributed to the

introduction of high yielding varieties and bringing more area under cultivation. The per hectare consumption of high NPK increased from the meager 0.6 Kg. in 1950 t0 more than 70 Kg. by the year 2000. The ratio of N: P: K which should be ideally 4:2:1 has come down to nearly 7:3:1. The imbalance of fertilizer usage has implication on fertilizer use efficiency resulting in transport of excess nitrate into other segments of environment.

(b) Nitrogenous fertilizers

The atmospheric burden of N_2O is 1500 Tg (Terra grams) i.e. 1500 million tons and is increasing @ o.2% per annum of which agricultural and contributes o.8 Tg /annum. After 100 years, nitrogen oxide accumulation is likely to assume alarming proportion. If this trend continues, environmentalists feel that N_2O along with chlorofluorocarbons (CFCs) accumulated in the stratosphere will progressively deplete ozone layer. As a result, the effective shield for the earth against UV radiation will substantially decrease.

(c) Use of pesticides in agriculture

Synthetic pesticides have been very popular with the farmers because of their simplicity in application, efficacy and economic returns. Despite the fact that the consumption of pesticides in India is still very low, about 0.5 kg/ha of pesticides against 6.60 and 12.0 kg/ha in Korea and Japan, respectively, there has been a widespread contamination of food commodities with pesticide residues, basically due to the non-judicious use of pesticides. In a recent survey carried out by Indian Council of Medical Research, New Delhi, it was found that 51% of our food commodities were contaminated with pesticide residues and out of this 20% had pesticides residues above the MRL values, as compared to 21% contamination with only 2% above the MRL on world-wide basis. The difference in the pattern becomes more significant considering the fact that 66.5% of the pesticides are used in cotton and rice along. It is estimated that by the year 2010, about 20-30% of the pesticides will be replaced by biorational agents. One of the main reasons for this is that

all efforts are directed towards replacing the use of insecticides, neglecting herbicides and fungicides.

Excessive residues of toxic pesticides may threaten the human health and cause imbalance in ecosystem. India is fast emerging as an exporting country in the field of agriculture and the export of food commodities during 1997 has already reached Rs.1,15,832 million level. The commodities having excessive residues are unacceptable by the importing country and act as a non-tariff barrier.

(d) Decontamination and disposal of pesticidal xenobiotics

The disposal of excess quantities of pesticides, expired formulations and empty packs/ containers etc. is an important area of environmental significance. Deliberate pesticide dumping, leakage from waste disposal sites spillage during transportation or storage, discharge of effluents from factories as well as municipal and industrial treatments also contribute substantially to pesticide pollution. In the recent past, pesticide disposal through physical, chemical and microbiological means has received serious attention. Some of these options include i) construction of underground and above ground disposal pits, ii) evaporation beds, iii) filtration systems, iv) incineration, v) photodecontamination, vi) UV – ozonation and vii) biological processes involving microorganisms.

(e) Biopesticides

Being effective and environment friendly, biopesticides are considered as safe alternatives to otherwise toxic and highly persistent chemical pesticides. The microorganisms such as viruses and bacteria have been genetically improved for greater virulence, persistence and desired host range. Baculoviruses particularly Nuclear Polyhydrosis Virus (NPV) and Granulosis Virus (GVS) have been found to be effective against many key pests.Indigenous processes to producer NPVs of Heliothis armigera and Spodoptera litura and

GV of Chilo infuscatellus have been developed with suitable adjuvants for increasing the shelf-life and bioefficacy. Bacillus thuringienesis offers great promise in pest control and is being produced in large scale in the country. The active ingredient of Bt , the delta endotoxin and exotoxins are toxic to target organisms but are quite safe to nontarget organisms including mammals ,birds, fish, beneficial insects etc. Being toxic to mosquito larvae, and flies , it may find application in eradication of malaria.

Biotechnology and genetic engineering might help in evolving strains of plants giving higher yield of known natural pesticides. One may expect newer strains of chrysanthemum to produce higher yields of pyrethrum. Similarly genetically improved neem tree may give better yield of the active constituents like azadirachtins. Pesticide resistant genes have been isolated and successfully transferred to tobacco and tomatoes. In 1985, a gene from Bacillus thuringiensis was successfully introduced into living plants. The resultant plant is able to protect itself from insect pests.

(f) Organic farming

The gravity of the environmental degradation has drawn the attention of the scientists and planners towards finding out ecologically sound, viable and sustainable farming systems for different agroclimatic situations, keeping in view the needs of the present and future generations.

The available information on different aspects of organic farming is very meager and fragmented. However, India is not in a position at present to completely do away with the use of synthetic agrochemicals, especially the inorganic fertilizers, in view of the large demand of the increasing population for food commodities. Research projects for formulating organic practices should be framed by ICAR, SAUS and other agencies involved in agricultural research.

(g) Use of municipal and industrial wastes in agriculture

Municipal and industrial wastes, particularly from the agrobased industry such as sugar, distillery, pulp and paper and dairy are being discharged unabatedly into rivers, streams and seas defiling these fragile ecosystems. The distilleries in India alone produce nearly 40 billion-liter of wastewater containing about Rs 300 crore worth of plant nutrients such as potassium, nitrogen, phosphorus and sulfur. For example, the public is concerned about disease transmission by pathogens in sludge when it is applied to land. However, illness results from the use of raw and untreated sewage. No incidence of disease transmission has been traced to the use of digested sludge. In addition to digestion, the following procedures ensure that sludge is disinfected: long-term storage; pasteurization at 70^0C for 30 min; additions of lime to raise the pH to 12 or higher; and maintenance of the pH above 11.5 for 2 h or more; or the use of chlorine to stabilize and disinfect the sludge.

Sewage sludge contains an abundance of trace elements necessary for plant growth (Cu, Fe, Mn, Zn). The heavy elements likely to cause toxicities to plants in soils treated with large amounts of domestic sludge for a number of years are Cd, Cu, Zn, and possibly Ni. Plants can grow normally and yet contain concentrations of Se, Cd, Mo ,and possibly Pb that are toxic to man and animals.

9^{th} Plan Programme / Achievements

Even at the end of the 9^{th} plan, our pesticide consumption pattern is mainly dominated by insecticides (Table). Of these insecticides, nearly 80% is contributed by organochlorin insecticides like DDnd HCH.

Lacunae in our present water and soil resource management practices

India's progress in development of irrigated agriculture is the one single factor, which has been responsible in raising our food production to 208

million tons apart from other inputs such as fertilizer and pesticides. However, this single factor has also been responsible for most of the environmental ills (Table 3-5) we are facing due to agriculture since abundance of water led to transport of the chemicals and fertile top soil to natural waters defiling their fragile ecosystems. Presently the share of agriculture in total water consumption of the country is nearly 82% which is much higher than corresponding figure of 50% in the developed countries.

Watershed management programme is highlighted in Table-6.

10th plan: Suggested programmes

New directions for soil and water management

Development of Integrated Water and Nutrient Management (INM) practices which integrate organic manures with inorganic fertilizers and natural nutrient supply adequately backed up by precise and judicious water use should be made.

Since fertilizers and allied agrochemicals are potential contaminants of concern in integrated land and water management, their environmental implications are needed to be assessed and monitored on continuous basis.

Zero tillage practices should be supported by suitable incentives, as they can be very useful in economizing on inputs like water and fertilizers and reducing environmental pollution.

Application of modern tools such as modeling and GIS in resource management at regional level.

Linkages: ICAR, State Agricultural Universities (SAUs), State Agricultural Deptts.

Development and residue management of agrochemicals and neem products should be made.

The pesticide residue monitoring programmes of ICAR such as All India Co-ordinated Research Projects on Pesticide Residues, CSIR and ICMR should be strengthened for carrying out the regular monitoring of pesticide residues in soil, water and different food commodities, in the country. Other general universities having facilities for pesticide residue estimation should also be integrated in this programme.

There is a need for regular monitoring of food commodities by the export houses that have the necessary facility to undertake the job. In other cases such facilities should be created.

Regular monitoring of pesticide application implements should be carried out in different regions of the country to take adequate measures for safety of farmers' health

Use of DDT and HCH for agricultural and non-agricultural purposes should be totally banned in the country on top priority. These should be replaced with easily degradable pesticides. Accelerated thrust is required for development of botanicals and biopesticides.

Linkages: ICAR, ICMR, CSIR, DBT, State Agricultural Universities (SAUs)

Agrocycling of municipal and industrial wastes

An inventory of all municipal and agrobased industrial wastes showing their quantity and quality should be prepared for each State of the country.

A mechanism should be devised to avoid mixing of trade wastes in city sewage.

Treatment of sewage should be mandatory for all towns exceeding 5 lakhs population.

All the agobased industries should make arrangement for treatment of wastewater to the extent suitable for agricultural application. They should be encouraged to develop demonstration farms so those farmers have no hesitation in adapting to wastewater use.

Suitable agronomic packages involving either direct application of effluent or dried up or composted waste should be developed for wastewater utilization in different agroclimatic regions of the country.

Linkages:

Central and State Pollution Control Boards, Ministry of Agriculture, ICAR and State Agricultural Departments.

Eco-centric Resource Management for Environmental Protection in Agriculture: Priorities for the 10th five-year Plan

Emerging Issues	Researchable Issues	Linkages
Ecological and environmental characterisation	1. Assessment of soil, water, soil moisture, climate and crop resources using GIS, nuclear and other techniques	ISRO,SAC,NBSS&LUP,AIS&LUS, SAUs, NCAP,CRIDA,NASA,WTCs WAMIs &CAZRI
Soil resource management	1. Development of soil health indices and restoration of soil health for sustainable production	NBSS&LUP and SAUs
Water resource management	1. Planning and management of land and water resources and evaluation of irrigation systems 2. Water nutrient management for crop production 3. Development of on farm management technologies 4. Technologies for watershed development	Ministries of water resource and agriculture, WTCs, WAMIs, ICAR, IITs and State Agri Dep.
Development and residue management of agrochemicals and neem products	1. Development and residue management of agrochemicals 2. Monitoring of pesticide residues in food commodities 3. Monitoring of pesticide application implements and farmers' health 4. Development and management of neem products and other botanicals	AICRP on Pesticide Residues, ICAR, CSIR, ICMR, DBT and SAUs General Universities
Agrocycling of municipal and industrial wastes	1. Assessment and utilisation of municipal, agricultural and industrial wastes and monitoring of soil health and crop productivity 2. Processing and fortification of agricultural residues and their utilization.	Ministries of Environment & Forests, CPCB, SPCBs, Agriculture Deptts, concerned industrial sectors, SAUs, NEERI and MNES
Alternative agriculture	1. Organic farming 2. Development and management of biofertilisers and biopesticides	ICAR, SAUs and State Agri. Deptts

Existing Regulations List

India is the first country, which has made provisions for the protection and improvement of environment in its Constitution. In the 42nd amendment to the Constitution in 1976, provisions to this effect were incorporated in the Constitution of India with effect from 3rd January 1977. In the directive Principles of State Policy in Chapter IV of the Constitution. Article 48 was inserted which enjoins the State to make endeavour for protection and improvement of environment and for safeguarding the forest and wild life of the country. Another landmark provision in respect of environment was also inserted by the same amendment, as one of the Fundamental Duties of every citizen of India. This is the provision in article 51-A (g) of the Constitution. It stipulates that it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures. As of date following legal provisions exist for the protection of environment.

- The Water (Prevention and Control of Pollution) Rules, 1975
- The Water (Prevention and Control of Pollution)(Procedure for transaction of Business) Rules, 1975
- The Water (Prevention and Control of Pollution) Cess Rules, 1978
- The Air (Prevention and Control of Pollution) Rules, 1982
- The Air (Prevention and Control of Pollution Union Territories) Rules, 1983
- The Environment (Prevention and Control of Pollution) Act, 1986.
- Hazardous Waste (Management and Handling) Rules, 1989.
- Manufacture, Storage and Import of Hazardous Chemical Rules, 1989.
- Scheme on Labelling of Environment Friendly Products (ECO-MARK)
- Restricting certain activities in special Specified area of Arawalli Range.
- The Public Liability Insurance Rules, 1991.

All the agribased industries are covered under these legal provisions, however, the agricultural activities are mainly causing non point pollution for control of which sufficient legal provisions are lacking. The agricultural products contaminated with agrochemicals are governed under Prevention of Food Adulteration rules. Additional legislation will only be necessary if the existing legislation is fully implemented.

Table 1. Percentage consumption of different pesticides in India

Pesticides	Consumption (%)	
	World	India
Herbicides	47.5	15.76
Insecticides	29.5	80.45
Fungicides	17.5	1.46
Others	5.5	2.33

Table 2. The consumption of pesticides and cropped area

Crop	Pesticide share (%)	Cropped area (%)
Cotton	52-59	5
Rice	17-18	24
Vegetables and fruits	13-14	3
Plantation crops	7-8	3
Cereals/oilseeds/pulses	6-7	58
Sugarcane	2-3	2

Table 3. Extent of Soil Degradation (human induced) in India

Degradation type	Area affected in million hectare	Per cent area affected
Water erosion	**148.9**	**45.3**
Loss of top soil	132.5	40.3
Terrain deformation	16.4	5.0
Wind Erosion	**13.5**	**4.1**
Loss of top soil	6.2	1.9
Loss of top soil /Terrain deformation	4.6	1.4
Terrain deformation/Over blowing	2.7	0.8
Chemical Deterioration	**13.8**	**4.2**
Loss of nutrients	3.7	1.1
Salinization	10.0	3.1
Industrial waste discharges	-	-
Physical Deterioration	**11.6**	**3.5**
Waterlogging		
Total affected area	**187.7**	**57.1**

Table 4. Soil erosion and sediment estimates

Particulars	**Amount (in tonnes)**
Total soil erosion	5334
Sediment load of major, medium and minor rivers	2052
Sediment deposition in reservoirs	480

Table 5. Estimated total problem areas (in lakh hectares) in different states of India

States/Uts	The problem area	Area treated till end of VII plan (1980-90)	Balance yet to be treated
1. Andhra Pradesh	122.31	10.55	111.76
2. Arunachal Pradesh	26.54	0.26	26.28
3. Assam	29.99	2.22	27.77
4. Bihar	65.52	13.49	52.03
5. Gujrat	125.86	24.51	101.35
6. Haryana	41.62	5.88	35.74
7. Himachal Pradesh	19.14	2.93	16.21
8. Jammu & Kashmir	8.93	2.46	6.47
9. Karnataka	114.03	33.29	80.74
10. Kerala	19.35	4.42	14.93
11. Madhya Pradesh	207.17	42.84	164.33
12. Maharashtra	198.46	106.19	92.27
13. Manipur	7.34	1.05	6.29
14. Meghalaya	11.02	1.12	9.90
15. Mizoram	6.10	0.12	5.98
16. Nagaland	10.38	0.95	9.43
17. Orissa	78.03	7.91	70.12
18. Punjab	32.30	7.96	24.34
19. Rajasthan	342.22	17.08	325.14
20. Sikkim	3.03	1.49	1.54
21. Tamil Nadu	38.22	14.11	24.11
22. Tripura	2.79	1.33	1.46
23. Uttar Pradesh	131.15	33.36	97.79
24. West Bengal	43.03	3.77	39.26
25. Goa	2.00	0.05	1.95
26. A&N Islands	2.59	-	-
27. Chandigarh	0.01	-	-
28. Dadra&Nagar Haveli	0.12	-	
29. Delhi	0.75	1.25	2.25
30. Daman and Diu	-	-	-
31. Lakshadweep	-	-	-
32. Pondicherry	0.03	-	-
33. Total	1704.68	340.59	1349.44

Sandy areas (14.65 lakh ha) not included

Watershed management programme is highlighted in Table-6.

Table-6. Watershed Management programmes in India

SOURCE	YEAR	NAME OF PROJECT	MAGNITUDE
Central Govt.	1960	♦ DamodarValley corpn.	Construction of 5 multipurpose dams
Ministry of Agriculture	1988	♦ National Watershed Dev. Proj. for Rainfed Areas	In 2466 watersheds and 105 agro-climatic zones
Multinational and Bilateral Projects	1991	♦ Integrated Watershed Development Proj.(Hills)	In Haryana, H.P., J&K and Punjab.
	1991	♦ Integrated Watershed Development Proj.(Plains)	Guj.,Orissa & Gujarat
World Bank Funded Projects	1990-91	♦ DANIDA assisted comprehensive Watershed Development project	In Karnataka and Orissa
	1989-93	♦ EEC assisted projects	Hills of U.P. and M.P.
	1992	♦ Germany assisted Project	Karnataka
Min. of Rural Development & Employment	1989	♦ Integrated Wasteland Development Project	98 projects in 20 states
	1987	♦ Drought Prone Area Programme(DPAP)	627 blocks in 96 districts
	1987	♦ Desert Development Programme	131 blocks in 21 districts.
	1994	♦ Integrated Jawahar Rojgar Yojna	120 districts in 12 states
	1993	♦ Employment Assurance Scheme	1778 blocks in 261 districts
Soil and Water Conser. Dept.	1960	♦ Catchments in River Valley Projects	29 catchments in 18 states
	1980	♦ Catchments of Flood Prone Rivers	234 watersheds in 8 states
	1994	♦ Watershed area of Shifting Cultivation	In N-E States
Externally Aided Programmes	1990-92	♦ Indo-German Bilateral Programme on Watershed Management	In 5 states
	1994-95	♦ Integrated Watershed Management in Ravinous Areas of M.P., U.P.	Agra, Etawah Firozabad Gwalior and Jhansi
Ministry of Environment and forests	1989-90	♦ Integrated Afforestation and Eco-Development Projects Scheme	Relmajra, Punjab

MINERS' HEALTH*

Mining has always been a hazardous occupation. Nature has bestowed India with rich mineral resources spread over diverse geographic and climatic conditions. Mining sector employs more than one people in coal, metalliferous and other mines.

TABLE – 5 Mineral Deposits and Employment in India

Mineral	Deposits (Million tones)	Empl. (*000)
Coal	2,00,000	500
Copper	422	15
Lime stone	7,600	50
Iron	1,200	43
Manganese	176	22
Causative	250	15
Chromite	88	10
Lead & Zinc	215	20
Other (Gold, Diamond, Gypsum, Mica, etc.)	-	325
Oil	-	55

The major health problems among miners are injuries and accidents, which are associated with machinery, explosives, fire, floods and gassing. Ordinary hand tools contribute to a large number of minor accidents and transport of men or materials in vertical or inclined shafts contribute to more serious ones. Other occupational illnesses among miners include fatigue, exhaustion and heat stroke due to heat stress, noise induced hearing loss; eyestrain, nystagmus and accidents due to poor illumination. Exposure to dust causing silicosis, anthracosis, asbestosis, lung cancer, mesothelioma of pleura and peritoneum has been well documented in literature.

*Dr.S.K. Dave, Director, NIMH, Kolar Gold Fields, Karnataka

ACTIVITIES/INITIATIVES DURING IXTH PLAN

- Environmental cum medical surveys have been carried out extensively among coal miners in the Eastern Region of the country.
- Exposure of miners to asbestos fibers during mining and milling in Andhra Pradesh, was brought down through engineering control measures suggested by NIOH and strict application of legislative measures.
- Indo-US Collaborative Programme in Manganese mines at Balaghat (M.P.) has been initiated by NIOH.

PROGRAMME FOR XTH FIVE YEAR PLAN

Database generation on occupational & environmental problems of miners should be carried out. This should include analysis of fatal and non-fatal injuries and environment evaluation for heat stress, noise level, illumination, vibration, radiation and total & respirable dust.

Nodal Agency : Ministry

DISASTER MANAGEMENT*

A disaster is a severe disruption, ecological and psychosocial, which greatly exceeds the coping capacity of the affected community. In essence, it represents stress both at the macro (community) and micro (individual) level. In the past two decades, natural disasters have claimed about 3 million lives and adversely affected at least 800 million people worldwide. Considering the case of developing nations, the actual number killed in disasters is estimated to be 3 to 4 times higher than in the developed nations. The striking difference however, is in the magnitude of the affected population, which is estimated to be 40 times more in the developing countries. Therefore, in the majority of developing countries, consequences of disasters, because of their frequency and severity, represent a real public health priority.

As opposed to natural disasters that have been extensively studied, major industrial accidents have only seldom been the object of systematic epidemiological studies. Many developed nations have formulated comprehensive disaster management plans wherein the health aspect is covered holistically through inclusion of mental health component e.g. As in australia. In india the disaster management has still not received importance although major disasters have taken place during the last two decades. The experiences gained with the occurrence of gas exposure at bhopal and earthquake disaster at latur and gujarat and also the cyclone disaster at orissa have provided ample data for preparing guidelines for facing such calamities in future.

Activities/initiatives during ixth plan

Ministry of labour and ministry of environment have set up crisis management groups at central, state, district and local levels. Each state has prepared off-site and on-site plans for MAH industries , and mock drills are also carried out.

*Dr.Bela Shah, Senior Dy.Director General, ICMR, New Delhi

PROGRAMME FOR XTH FIVE YEAR PLAN

(A) Chemical Disasters

- Awareness and training of medical and para-medical personnel on health aspects of chemical disasters / accidents.
- Mobile vans for monitoring toxic chemicals in emergency situations.
- Availability of antidotes at various hospitals of each state.

(B) Natural Disasters

- Disease surveillance cell for floods, earthquakes, cyclones etc.,.
- Training in epidemiology and posting of epidemiologists at district levels.

Nodal agency: MoH&FW, MoE&F, Ministry of Labour, Ministry of Industries.

3.2.3. POISONING AND EXPOSURE TO HAZARDOUS CHEMICALS*

Preamble

In the past few decades, increasing availability and use of chemicals in industrial, agricultural and domestic fields has led to a worldwide increase in the incidence of human poisoning. Each year between 1000 to 2000 new chemicals are introduced into the market. The global burden of disease due to poisoning was calculated at 0.5% of all DALYs in 1990 but this is likely to be a significant underestimate since many chronic poisonings are not recorded as such. In the 1998 annual report of American Association of Poison Control Centres, 2,241,082 human poison exposures have been reported from a population base of 257.5 million. The overwhelming majority of human exposures were acute (93.7%). With the advice from the poison center, 75.2% of cases could be managed at the site of exposure, which is usually patient's home. The substances most commonly involved in human exposures were cleaning substances, analgesics, cosmetics and personal care products, plants etc. whereas pesticides were responsible only in a small percentage of cases (3.9%).

Poisoning can be due to a variety of agents but in developing countries like India, pesticides are the major cause of all poisonings. Pesticide poisoning can occur via oral, respiratory or coetaneous routes of exposure, at work or in the home, through accidental or intentional exposure. High morbidity and mortality rates, often exacerbated by inappropriate diagnosis and lack of treatment are often reported from developing countries. There is very limited reliable data on the epidemiology of pesticide poisoning and human exposures to pesticides. Easy availability and lack of restrictions also

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contributes to frequent use of pesticides in suicide attempts in countries like India.

Chronic exposures to toxic chemicals represent a more serious health threat and these exposures have been linked not only to poisoning, but also to congenital malformations, cancer, fertility problems and behavioural and immunological disorders. Of particular concern are the toxic metals: lead, cadmium and mercury. The production and use of chemicals that remain in the environment for long periods have also become and environmental health issue. For instance, chloroflurocarbons, other halocarbons and halons have become widely used in industry (as refrigeration fluids, foam-fillers and aerosol propellants) partly because they are non-toxic to humans. But halogen radicals, which are produced following the release halocarbons and halons, upset the balance between the oxygen and ozone concentrations in the stratosphere, leading to a steady decline in ozone levels. As ozone filters out a major part of the ultraviolet radiation that reaches the Earth from sun, this decline has serious implications for human health (in terms of higher incidence of skin cancers and cataracts, damaged immune response) and for the global ecological systems on which all life depends. Some persistent chemicals have more direct effects on health. For instance, DDT has been used as pesticide for many years and is considered to have very low acute toxicity in humans. However, its long-term effects in mimicking steroid hormones make DDT an " endocrine disruptor". It is also one of the " Persistent Organic Pollutants" (POP). And because POPs remain in the environment for a considerable time, their concentrations can increase to levels that eventually health effects.

Chemicals in drinking water:

Both naturally –occurring and man-made chemicals in drinking water can cause serious health effects. Fluoride levels of 0.5-1 mg/l provide substantial protection against dental caries. However, the margin between beneficial and toxic levels of fluoride is rather narrow and higher levels of fluoride in drinking-

water can cause adverse health effects ranging from unsightly dental fluorosis to crippling skeletal fluorosis. Priority areas for action include development of alternative safe drinking water sources, appropriate water treatment technology for arsenic removal, treatment of patients and public awareness.

Addition of fertilizers to agricultural land can lead to excess of nitrates in the drinking water and this can lead to serious, even fatal, consequences especially in infants who are fed formula prepared with such water.

AVAILABLE DATABASE IN INDIA:

In post independent India, rapid increase in population requires a substantial increase in food crops and thus need for agrochemicals. Industries have grown but poor work practices in the unorganized sector have led to occupational exposures to a variety of chemicals causing acute and chronic health effects. In the present circumstances, poisoning due to different agents is responsible for a significant number of hospital admissions in India. In India, as in other countries, mass poisonings due to any cause receive a great deal of media coverage, but it is the individual patients of poisoning which in reality make up the bulk of poisoning cases. It is difficult to quantify the problem of poisoning in India due to many reasons. The number of published reports is limited and mostly based on hospital data. All these reports show that majority of acute poisonings in India are intentional (suicidal) where the underlying causes often are economic hardships, marital disharmony or psychiatric problems. Exposure to pesticides is a major cause of poisonings. Data from Haryana shows app. 5 times increase in the cases of acute poisoning over a period of 10 years starting 1982. The problem of Aluminium phosphide poisoning was almost non-existent before 1985, but many other hospital based studies published thereafter report Aluminium phoshide as the commonest cause of intentional poisonings from northern parts of India viz., Haryana, Punjab Delhi and Rajasthan. All these studies point out that pesticides especially organophosphates are the commonest agents responsible. Organophosphate pesticide poisoning is associated with

high morbidity and mortality and requires intensive medical care. The public health, economic and social burden of pesticide poisoning is high due to costs of hospitalization and treatment, the related loss of productivity and effects upon family life and the community. Patients may need hospitalization from one week to on month. The minimum cost of treatment for one patient who stays in the ICU for about 8-10 days comes to Rs.10, 000-15,000.

Chronic poisoning due to chemicals present in the environmental media is being reported from India. The problem of Fluorosis is endemic in 15 states of India. Recently, in six districts of West Bengal and several villages in Bangladesh that border India, very high levels of Arsenic (70 times higher than the national drinking-water standard of 0.05 mg/l) have been detected in the ground water, the main source of drinking water. It is estimated that nearly 30 million people may be at high risk of arsenic exposure. Arsenic toxicity can manifest as skin lesions including skin cancer, peripheral neuropathy and peripheral vascular disease. In West Bengal alone, 200 000 people have been reported to be suffering from arsenical skin lesions.

Natural toxins present in food can also lead to poisoning epidemics and this was demonstrated by Epidemic dropsy, which affected more than 4000 persons from different parts of India and was caused by contamination of mustard oil with Argemone seeds.

International Concern About Chemical Safety

In the 1970s, international concern about the dangers of chemicals led to the United Nations Conference on the Human Environment in 1972 at Stockholm, Sweden. In 1977, the World Health Assembly, decided to develop long-term strategies to control and limit the impact of increasing manufacture, use, storage, transport and disposal of chemicals. The International Labour Organisation (ILO) and United Nations Environment Programme (UNEP) joined WHO in setting up the International Programme on Chemical Safety (IPCS) in 1980. The IPCS provides guidelines for assessing the risk of

chemicals to human health and gives technical support to different countries to strengthen their chemical safety programmes. One of the major thrust areas in chemical safety is the development and strengthening of Poison Information Centres especially in developing countries.

Role of Poison Information Centres in Toxic Exposures and Poisoning

Poison Information Center is an organization, which provides following services

- Poison information, telephone management advice and consultation about toxic exposures (chemicals, pesticides, drugs, plant and animal toxins).

- Hazard surveillance to achieve hazard elimination.

- Professional and public education in poison prevention, diagnosis and treatment.

10th Plan : Suggested Programme Activities

Guidelines for Poison Information Centers/Control Centers in India

Keeping in view the increasing use of chemicals in every walk of life and growing Govt. and public concern about chemical safety, it is imperative to have a network of Poison Information Centres in India, which will not only provide the much needed emergency guidance in the event of individual or mass poisoning but also give scientific advice in chemical risk assessment. Guidelines published by WHO/IPCS for setting up Poison Information/Control Centers are available and these can be used as a reference to develop our own poison information centers in the country. However, we have to keep in mind the health care system, the transport facilities and the type of problems encountered in the country. So it is proposed that for the 10th Five-Year Plan,

initially six regional poison centers may be set-up in different parts of India followed by one poison information centre in each major state. Some of these centers are already partly functional either as Poison Information or Poison Control Centers with or without analytical laboratory facilities. The locations suggested are as follows:

1. All India Institute of Medical Sciences, New Delhi
2. Govt. General Hospital, Chennai
3. K.E.M. Hospital, Mumbai
4. PGI Chandigarh
5. NIOH & New Civil Hospital, Ahmedabad
6. ITRC & SGPGI, Lucknow

These six centers should have the following functions.

1. Poison Information

The Center should provide round the clock information to medical personnel, other professionals and members of community. The information will be helpful in providing first aid to poisoning cases and also help in correct management of such cases. By providing telephonic consultation to the general community, unnecessary visits to emergency wards of hospitals can be avoided and this can save precious resources. The mode of providing information can be by a telephone, by fax, e-mail and through letters. Information can also be provided about the hospitals and other health care facilities available in the region where the poisoned patients can be managed. The information should be available 24 hrs a day and 365 days a year.

Location of Poison Information Center

The Information Center should be located near the hospital and preferably adjacent to the clinical toxicology unit. Those centers, which are already

functioning as information centers, can develop linkages with neighboring hospitals, which will house the clinical toxicology unit.

Staff

The Center should be under the charge of a medical/clinical toxicologist who should have wide experience in the areas of clinical medicine, toxicology and pharmacology. The persons who provide information for acute poisoning cases should preferably be postgraduate students of medicine and posting in Poison Information centers can be part of their postgraduate training. This is also necessary due to existing restrictions on new recruitments. Nurses may also be trained to answer routine calls to the public. There should be one person available all the times to answer telephone calls. One psychiatrist and one medical social worker may be attached to the poison center. Separate secretarial assistance should also be provided to the center.

Facilities

Poison Information Center should have a separate space (approx. 2000 sq.ft.) with adequate furniture, **two dedicated telephone lines which should be toll free,** and other facilities like Computers with internet facility, Fax, Photocopier and adequate Library facilities like books and data bases. There should also be facilities for teaching and training.

Data recording and analysis

All incoming and outgoing calls should be recorded in a harmonized format (like the INTOX format of IPCS /WHO). The data should be analyzed regularly to determine the poisoning trends in the country. In the area covered by each poison information center it should make compulsory that all poisoning cases reported to any healthcare facility should be reported to the regional Poison Information Center. This will be helpful in determining the trends and taking appropriate corrective measures.

2. *Clinical toxicology Units*

Each unit should comprise of 24 beds cordoned off into adjacent sub units as follows:

8 beds for ICU, 8 beds for Intermediate ward and 8 beds for general ward. In addition, the emergency department, which receives the poison cases should have facilities for decontamination. These clinical toxicology units in these six centers will function as centers of excellence and offer teaching and training in clinical toxicology to medical persons, para-medics and nurses. Teaching will also be imparted to doctors and para medics deputed from primary health centers, ESI dispensaries, District hospitals, and other medical colleges.

The staffing pattern in the ICU of the clinical toxicology unit in each of the three shifts per day should necessarily be nurse patient ratio of 1:1 to ensure adequate haemdynamic monitoring, frequent suction,etc. These clinical toxicology centers will be having close coordination with the regional poison information center and analytical laboratory services.

Poison information centers which are integrated with clinical units carry out treatment, follow up of poisoned patients and evaluation of treatment efficacies. Toxicology treatment centers can serve as referral centers for patients requiring advanced toxicology evaluation and treatment. Goals of such in-patient treatment centers include enhancing care of poisoned patient, strengthening toxicology training, and facilitating research.

3. *Analytical laboratory services*

Every emergency unit in a hospital has 24 hrs laboratory service. The personnel in these laboratories can be trained in analytical toxicology. These laboratories will support on a 24 hrs basis the functioning of the clinical toxicology unit to aid in diagnosis of poisoning cases in doubtful cases and

also determine drug kinetics. These laboratories may have simple tests like TLC and colorimetry to start with. More sophisticated analysis like estimation of metals, drug levels etc. can be done in referral laboratories with which the poison centers can develop liaison. The results of emergency toxicological analysis should be available within 2-4 hrs. to be of use to the clinical toxicologist.

4. Antidote bank

Important antidotes for specific poisons, which are rare to come by, and especially some, which are available only abroad, may be indented and stored in the poison center. The storage of these antidotes should be under proper temperature and environmental conditions. In the event of a chemical disaster or isolated poisoning episode, which require treatment with such antidotes, the local hospitals can bank on the antidote bank for speedy withdrawal of supplies and specific treatment. The various types of antidotes and their efficacies have been categorized by IPCS/WHO. It is also important for the government to encourage pharmaceutical companies to manufacture antidotes in the country by providing special incentives.

5. Teaching and Training

Teaching and training of doctors and para-medicos working in remote villages in primary health centres as well as district hospitals and private sector hospitals is of paramount importance which will help in decreasing the morbidity and mortality of poison cases as a whole. In addition, BLS (Basic Life Support) training also should be imparted to the medical/paramedical personnel for giving effective first-aid in poison emergencies.The centers can work to gather to develop educational materials in the form of leaflets and pamphlets in different languages for the education of the public and the treating doctors.

6. Research in clinical toxicology

The clinical toxicology units will have abundant human toxicology data. Therefore, research on various aspects of poisoning such as utility of various

antidotes, toxico kinetics and new treatment methodologies can be undertaken with the approval of regional ethics committee.

7. Chemical Disasters

Poison Information centers can be a focal point in providing and disseminating information to the public and the treating physicians in the event of a chemical disaster resulting from industrial accidents, transport or disposal of chemicals.

8. Networking of poison information/control centers

ISDN lines for teleconferencing and imaging facilities to share the data on poisons and to seek help in doubtful emergencies should link different centers in the country. The centers can also establish linkages with international network of Poison centers. In the long run, poison information and control centers can become an essential part of the existing health care system.

9. Toxicovigilance and prevention of poisonings

From the data reported to the poison information centers, toxic risks in the community can be determined and appropriate authorities/poison centers/media can be alerted. After verifying the authenticity of the data thus obtained, the information may be relayed via media (Press, television, etc. with whom poison information centers should develop close links) so that the affected sections of the public may be alerted and preventive action can be taken .

Recommendations:

- Establishment of six Regional Poison Information Centres in the first phase
- Each major state to have one Poison Information centre in the next phase
- Medical curriculum to give due emphasis to " Clinical Toxicology"
- Training of in-service doctors in " Diagnosis and Management of Poisoning"
- Poison centers should have linkage with all national programmes related to Toxic Chemical Exposures
- Poison centre should be a part of "State Crisis Group"
- Urgent action for availability of " Antidotes"
- Reporting of Poisoning cases to be made mandatory

3.3 HEALTH PROBLEMS OF VULNERABLE GROUPS RELATED TO WORK AND ENVIRONMENT*

Women:

Over the years, women's health needs have been addressed through maternal and child health programmes, focused primarily on a narrow aspect of their lives. However, women' health is affected by a number of factors including their work and biophysical environment. To understand women's health problems from a holistic angle, it is important to understand the difference between sex and gender.

Sex: Genetic/physiological or biological characteristics of a person, which indicate whether one is female or male.

Gender: Refers to women's and men's roles and responsibilities that are socially determined. Gender is related to how we are perceived and expected to think and act as women and men because of the way society is organized, not because of our biological differences.

While the last decade has seen much work done on identifying the linkages between gender and the environment, the interaction between environmental factors and gender on women's health remains a relatively unexplored area due to paucity of hard data.

Women & work: It is a fact that all women work. They perform dual roles of production and reproduction. Their work goes unrecognised because they do a variety of jobs daily, which does not fit into any specific 'occupation'. Most of them are involved in arduous household work. Although women work for longer hours and contribute substantially to family income, they are not perceived as workers by either the women themselves.or data collecting agencies and the government. The world economy as it stands today, is built on such unpaid labour and ruthlessly exploited human resources of which women's labour forms a major portion.To understand the issue of occupational health problems of women it is necessary to make a detailed

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- ALL WOMEN WORK AT HOME, MORE ARE ALSO WORKING OUTSIDE
- WOMEN'S WORK REMAINS INVISIBLE
- TWO-THIRD OF WORKING HOURS AROUND WORLD ARE WORKED BY WOMEN (ILO)
- WOMEN CONTRIBUTE A MAJOR SHARE TO WORLD ECONOMY

study of the women's work in terms of the actual activity undertaken, the hours of work and the extent of remuneration received.

Available database

The pattern of employment of women is very different among different countries: In developed countries, most of the women are employed in white-collar jobs or as semiskilled operatives in manufacturing industries. In India on the other hand, according to 1981 census, workforce participation by females was barely 15% (main workers) as against 51.6% amongst males. According to the 1991 census, the participation of female workers has increased to 16.03 % (main workers) and for males it has been recorded as 51% . In addition, 6.24% of females have been shown as marginal workers and the remaining 77.7% of women (305.2 million) are shown as a non working population (Indian Labour Statistics, 1994, Labour Bureau, Ministry of Labour, Shimla (1996). The 1991 census also shows that of these 16.03% main women workers, 80.8% are employed in agriculture, 3.5 % in house hold industries, 4% in other industries, 0.,3% in mining and quarrying 0.6 % as construction workers and only 10.8% in other services.

However, there is gross underestimation of women's work to the extent of 30-40% as marginal workers. A large number of these marginal women workers are engaged in occupations in order to supplement family income in various ways such as collection of firewood, cowdung, maintenance of kitchen gardens, tailoring, weaving and teaching. Moreover inadequate attention has been paid to 'unpaid family labour' and household work. Quantification of

these activities in terms of work hours contributed or its income generating equivalent is rarely attempted.

In India, most of the women are employed in the unorganised sector, this sector includes agricultural labourers, workers in traditional village and cottage industries, migrants to the cities in domestic service, day labourers, street vendors etc. In agriculture, the most important occupation in developing countries, women play an important role in agricultural production, animal husbandry and other related activities such as storage and marketing of produce, food processing etc. Apart from these activities, they work almost 10-12 hours per day doing household chores.

Factors affecting the total health of working women in developing countries.

Population: In developing and overpopulated countries like India, poor working women are at a great disadvantage as due to availability of excess labour, there is always insecurity of job. Introduction of newer technologies often adversely affects unskilled women workers who are the first to suffer loss of job.

Poverly, illiteracy, malnutrition and infectious diseases: Women workers of many developing countries are caught in the vicious cycle of low productivity, low income, undernutrition and disease leading to lower work capacity. Low literacy level and lack of public amenities further contribute to ill health.

Sociocultural beliefs: In many communities in India birth of a girl child is unwelcome and women submit to multiple pregnancies till a male child is born. This adversely affects the health of the mother and reduces her working capacitity besides posing the extra load of caring for a large family.

Low status of women: The status of women in a society is largely affected by its cultural beliefs. In India, obedience to and dependence on men (father, husband and son) is considered traditional and sacred. This often culminates in the girl child getting minimum nutrition, poor education and poor access to health care facilities.

FACTORS AGGRAVATING OCCUPATIONAL HEALTH PROBLEMS OF WOMEN IN DEVELOPING COUNTRIES

- *OVERPOPULATION*
- *POVERTY*
- *MALNUTRITION*
- *SOCIO-CULTURAL BELIEFS*
- *MULTIPLE PREGNANCIES*
- *INFECTIOUS DISEASES*
- *ILLITERACY*
- *TYPE OF WORK(HEAVY MANUAL WORK)*
- *ADVERSE CLIMATIC CONDITIONS*

perspective: Work related health problems of women as seen from a gender

Work-related diseases are broader in scope and include occupational diseases. These are multifactorial diseases, which may frequently be work-related, but may also occur among general population. However, when such diseases affect the worker, they may be work-related in a number of ways; they may be aggravated, accelerated, or exacerbated by workplace exposures. Personal characteristics and other environmental and socio-cultural factors usually play a role as risk factors for these diseases.

Thus work-related diseases would include those diseases in which work is:

- the necessary cause (occupational diseases)
- a contributory –cause factor, not a necessary one
- provoking a latent or aggravating an established disease
- offering ready accessibility to potential dangers

Basically hazards posed by physical, chemical and biological agents are similar for male and female workers but the following factors specially affect women workers.

1. Women on an average, have a smaller stature and have less physical strength; their vital capacity is 11% less; their hemoglobin is app. 20% less; there is a larger skin area to circulating volume; they have larger body fat content. They have lower heat tolerance and greater cold tolerance.
2. Woman's unique reproductive function exposes her unborn child to workplace hazards.
3. Women shoulder additional burden of household work, care of children and social responsibilities.

1 **Occupational stress:** is one of the major problems from a gender perspective: Studies from developed countries show that sources of stress in women's lives are more diverse and diffuse than those experienced by men. A number of factors cause stress among working women.

a) **multiple overlapping roles** as housewives, mothers and workers especially when such roles are physically and mentally demanding with little satisfaction, monetary gain or social rewards.

b) **Types of job, repetitive and monotonous:** Jobs with little control over work pace and methods, job insecurity due to daily wage system overwhelming demands in certain jobs such as nursing and the need to prove to be the best, all lead to stress.

c) **Sexual harassment:** This is often faced by women in almost all types of occupations except when they occupy top level jobs. It is widely believed that employers show a preference for women only when they are prepared to accept lower wages, are expected to be more docile and submissive.

d) **Shift work:** In certain occupations, such as telephone operators who do different shifts including night shifts interferes with family life and leads to stress.

2. **Musculo-skeletal disorders and ergonomic issues.**

Women often perform heavy manual labour under subhuman working and living conditions. The added burden of malnutrition, repeated pregnancies and poor access to health services result in a number of health problems of which musculoskeletal problems are the commonest problems of women in the agricultural sector, unorganized sector and the self employed women.

Repetitive trauma is often the cause of a variety of musculoskeletal and neurological disorders in women. Work related musculoskeletal disorders of the neck and shoulders and upper limbs are also known as cumulative trauma disorders (CTD). Evidences from a number of studies suggest that all these disorders principally result from; constrained working posture, monotonous and repetitive work and psychological stress. Even in mechanical jobs, most of the tools, machines and workstations have been designed for average male.

3. Reproductive health hazards:

Many chemicals pose hazards to the embryo especially during organogenesis. This has led to restriction on the employment of women in various hazardous processes under various legislations (e.g. factories act. etc). Exposure to volatile organic solvents, dusts and pesticides and VDT (Video display terminal) nonionizing radiation has been found to be associated with increased risk of infertility in women. This could be due to interference with ovulation, fertilization or implantation.

3.1 **Exposure to solvents** increases the risk of spontaneous abortions and there is sufficient evidence of association between exposure to toluene, methylene chloride, tetrachloroethylene, petroleum ether, xylene, formaldehyde, paint thinners and reproductive problems. In some countries, pregnant women are shifted to other jobs or sanctioned special maternity leave when exposures exceed 10% of threshold limit value. Women exposed to toluene have reported a greater frequency of menstrual dysfunction including dysmennorhoea, irregular cycles and spontaneous abortions.

3.2 Occupational dust exposures (wood and agriculture based) have also been associated with adverse pregnancy outcome. It is not definite whether it is due to the preservatives such as pesticides or other agents like pentachlorophenol, creosote, formaldehyde, chromium, arsenic etc. Aflatoxins, one of the commonest mycotoxins found in agricultural grain dusts are known teratogens.

3.3 Pesticides: Maternal occupational pesticide exposures have been identified as a risk factor for stillbirth. Organochlorine pesticides,

polyhalogenated biphenyls and chlorophenoxy herbicides such as 2,4-D have shown teratogenic properties. DDT has estrogenic properties. Dioxins, polychlorinated biphenyls have been shown to create a variety of reproductive effects ranging from immune suppression, teratogenicity, hormonal disruptions and even endometriosis.

ENVIRONMENTAL HEALTH - A GENDER PERSPECTIVE

The environmental degradation and pollution due to industrialization and automobiles are a matter of urgent global concern for the communities at large but more specifically for very young, very old, disabled and vulnerable groups like pregnant women. The heavy ecological stress over the last 20 years – deforestation and depletion of natural resources – has drastically altered the relationship between women and living systems, which support their life. Being primarily responsible for the collection of fuel and water, depletion of these resources has added considerably to women's burdens in the struggle of day-to-day survival. It has added several hours to their already long workdays. Women tend to respond to these acute scarcities by limiting cooking, washing and cleaning. This has serious implications on the health of the whole family.Three aspects of environmental pollution are of special relevance to women's health.

- Indoor air pollution
- Environmental tobacco smoke (ETS)
- Environmental endocrine disruptors

Indoor air pollution: The use of biomass fuels such as wood, dung and agricultural waste; and the use of coal as cooking fuel poses the risk of chronic respiratory disorders including chronic obstructive pulmonary disease (COPD). Women' responsibilities for cooking expose them to this risk disproportionately more than men. Biomass smoke is a complex mixture of aerosols, which contain significant amounts of several important pollutants such as carbon monoxide, suspended particulate matter (SPM), hydrocarbons and oxides of nitrogen. Besides, the smoke also contains many organic compounds that are toxic, mutagenic and carcinogenic.

Domestic cooking is one of the major occupations of the average Indian housewife who spends on an average 6 hours in the kitchen. Therefore, she is most likely to be affected by indoor air-pollution, which can cause both respiratory and non-respiratory effects. Many studies have reported attenuation in lung function, chronic cough and phlegm in women exposed to biomass smoke. Chronic obstructive pulmonary disease (COPD) though a disease of smokers, can also be caused by indoor air pollution (a combination of domestic fuel smoke and passive smoking). A retrospective study 1532 female patients attending a chest clinic in Delhi, over a period of 13 years, observed that 46 per cent of the patients reported regular exposure to kitchen smoke from biomass fuels. Chronic bronchitis was the most common illness, followed by bronchial asthma, pulmonary tuberculosis and bronchiectasis.

Adverse pregnancy outcome, such as stillbirth, early neonatal death, pre-term and term low birth weight have been found to related to exposure to biomass smoke.

Environmental endocrine disruptors:

In today's world, the society faces hazards that were neither imagined nor known a few decades ago. There is a risk of exposure to nearly 15,000 high-production volume synthetic chemicals many of which are contained in household products and are dispersed widely in the environment. More than, half have never been tested for their potential especially long-term toxicity. A great deal of concern is being shown towards the endocrine disrupting effects of these chemicals. These agents mimic or inhibit natural hormones, alter the normal regulatory function of immune, nervous and endocrine systems. Human health effects include breast cancer and endometriosis in women, alterations in pituitary and thyroid gland function.

Some studies have provided evidence of a link between exposures to dioxins and endometriosis. In pregnant women, exposure of foctus in utero to many persistent chemicals such as chlorinated hydrocarbon compounds like DDT, polychlorinated biphenyls etc. can interfere with reproductive development at critical stage.

Researchable issues:

- Research is needed on the combined impact of multiple factors such as socio-cultural factors, environment and work on the general health of women.
- There is need to carry out gender-specific research on the incidence of communicable diseases.
- Research on health hazards in the work place - such as women's mental health and reproductive health problems
- Effects of persistent chemicals in the environment on women's health
- Relationship between biomass fuels, indoor air pollution and chronic respiratory problems in women.

Recommendations

- Develop a database on women from a gender perspective in the organised, unorganised and agricultural sector
- Improve nutritional standards of women to increase productivity
- Education and information about workplace hazards and their prevention
- Implement policies and legislations which allow women to develop their full potential as human beings and pursue any occupation
- Provide option of flexible working hours and part-time job to women especially those with small children
- Design and develop tools/ work stations suitable from ergonomic angle as well as affordable to women
- Better housing and sanitation as for many women home is also their workplace

Children's Environmental health

In the developing world, children are subject to a vast array of health problems, which are related to environmental factors of poor sanitation and lack of access to clean water and safe food. Most of the global burden of diarrheal diseases occurs in children in developing countries and acute respiratory infections, especially pneumonia is the biggest cause of childhood mortality in infants under one year of age. Though malnutrition and low birth weight are recognized risk factors for pneumonia, particularly fatal pneumonia, indoor pollution from biomass fuels also plays a significant role in childhood respiratory infections. Even in developed countries, respiratory disease remains the most frequent childhood medical problem though disease pattern is dominated by asthma instead of pneumonia. Many of the infectious diseases such as measles, neonatal tetanus, poliomyelitis, diphtheria and pertussis are vaccine preventable. However, transmission of many of these diseases is associated with poor living conditions.

Besides the traditional health hazards rampant in developing countries, children today live in an environment that is vastly different from that of previous generations. Explosions in technology, information, population and material goods mark the end of the 20th century. One of the key contributions to the current technological age has been the discovery and use of thousands of new chemicals. Chemicals are ubiquitous in our environment worldwide, and traces of man-made chemical compounds (toxicants) are found in all humans and animals. In order to protect children more effectively and proactively, it is important to understand why children are more vulnerable than adults, what types of exposures affect children and which children are at particular risk.

Why are Children Not Just "Little Adults" When It Comes to Environmental Exposures?

Children, beginning at the fetal stage and continuing through adolescence, are physiologically very different from adults. They are in a dynamic state of growth, with cells multiplying and organ systems developing at a rapid rate. At birth their nervous, respiratory, reproductive and immune systems are not yet

fully developed. In the first four months of life an infant more than doubles its weight. Young children breathe more rapidly and take in more air in proportion to their body weight than do adults. They also have higher metabolic rates and a higher proportionate intake of food and liquid than do adults. The rate at which children absorb nutrients from the gastrointestinal tract is likewise different than the rate for adults, a fact that can impact their exposure to toxicants. For example, children have a greater need for calcium for bone development than do adults and will absorb more of this element when it is present in the gastrointestinal tract. When lead has been ingested into the gut, however, the body will absorb it in place of calcium. Consequently, an adult will absorb 10% of ingested lead, while a toddler will absorb 50% of ingested lead. Because metabolic systems are still developing in the fetus and child, their ability to detoxify and excrete toxins differs from that of adults. This difference is sometimes to the child's advantage, but more frequently they are not able to excrete toxins as well as adults, and thus are more vulnerable to them. Not only does a child's physiology differ from an adult's, so does its environment. In its first environment, its mother's womb, the fetus may be permanently damaged by exposure to a wide variety of chemicals that can cross into its bloodstream through the placenta. These chemicals include lead, polychlorinated biphenyls, methyl mercury, ethanol and nicotine from environmental tobacco smoke. Researchers are also looking at possible connections between health abnormalities and a group of chemicals called endocrine disruptors, which mimic the body's hormones and have been shown to disrupt reproductive and hormone systems in wildlife.

Behaviors characteristic of early childhood also affect a child's exposure to toxicants. In the first year of life the young child spends hours close to the ground where he or she may be exposed to toxicants in dust and soil as well as to pesticide vapors in low-lying layers of air. Normal development in early childhood includes a great deal of hand-to-mouth behavior, providing another avenue for exposure to such toxicants as lead in paint dust or chips and to pesticide residues. Children also spend more time outdoors than do most adults, often engaged in vigorous play. Because children breathe more air per

pound of body weight than adults do and because their respiratory systems are still developing, they are prone to greater exposure to and potential adverse effects from air particulates, ozone and other chemicals that pollute outdoor air.

Two other concerns bear addressing. Because they are exposed to toxicants at an earlier age than adults, children have more time to develop environmentally-triggered diseases with long latency periods, such as cancer and possibly Parkinson's disease. The effects of multiple and/or cumulative exposures to toxicants and their potential synergistic effects are also not known and demand further research.

Which Children Are Most Affected?

All children are affected by environmental hazards. Pollution and environmental degradation know no state, regional, or national border. Contaminants are transported through many media including air, water, soil and food throughout the world. However, children living in poverty are at a disproportionately higher risk for exposure to environmental hazards. Poverty can compound the adverse effects of exposure to toxicants because it is so often associated with inadequate housing, poor nutrition, and limited access to health care.

Available database

Though legally child labour has been banned in India, a large number of poor children in India start working at a very tender age and many of them are employed in the unorganized sector such as: carpet weaving, match industry, gem polishing, lock making industries etc. In cities, children are employed in almost all sectors like hotels, constructions sites, automobile repairing and fuel stations and as household servants. In and around Sivakasi, Tamilnadu, there are approximately 2700 match works and 200 fire works industries where a large number of children are employed. In these industries, children are exposed to physical, chemical, ergonomic hazards and they are also at a great risk of developing mental health problems.

Selected Known Environmental Hazards for Children :

Children face myriad environmental hazards, which fall into categories such as neurotoxins, endocrine disruptors, carcinogens, and respiratory irritants Discussed below are three selected environmental hazards known to seriously impact children's health.

Lead

Exposure to lead has been associated with an array of neurodevelopmental effects, including attention deficits, decreased IQ scores, hyperactivity and juvenile delinquency. Research has also shown an association between slightly elevated blood lead levels in children at the age of 24 months and lower general cognitive function at 5 years of age.

Air Pollution

Air pollution affects children more than adults because of their narrow airways, more rapid rate of respiration, and the fact that they inhale more pollutants per pound of body weight. Health effects associated with both indoor and outdoor air pollution include increased perinatal mortality, increased acute respiratory illnesses (e.g., bronchitis and pneumonia), aggravation of asthma, increased frequency of physician visits for chronic cough and ear infections, and decreases in lung function. Researchers are seeking to identify indoor and outdoor air pollutants that serve to exacerbate asthma. There is little doubt that high levels of air pollution are responsible for increased morbidity, and in some cases mortality, in children.

Pesticides

Children are often exposed to toxicants through the agricultural and home use of pesticides or the ingestion of pesticide residues on food or in water.Pesticides used today generally fit into five main categories: insecticides, herbicides, fungicides, nematocides and rodenticides. Children may be more vulnerable than adults to of low level chronic pesticide exposures. Researchers have become concerned about the potential associations between chronic pesticide exposures and chemical carcinogenesis, environmental estrogen disruption and developmental

neurotoxicity. Some pesticides may interfere with physiological processes of the child, including the immune, respiratory and neurological systems.

Childhood Diseases: There has been a worrisome increase in certain childhood diseases, and researchers are working hard to determine whether this increase is linked to environmental exposures. **Childhood asthma** has increased by more than 40% since 1980, The incidence **of two types of childhood cancers** has risen significantly over the past 15 years: acute lymphocytic leukemia is up 10% and brain tumors are up more than 30%. Although there are no registries for **learning disabilities and attention deficit disorders** among children, there has been growing attention in recent years to an apparent increase in both.

Researchable issues

1. Understanding of the developmental process, including the critical periods of vulnerability during which environmental exposures can cause adverse health effects
2. The environmental exposures that occur early in life and their relationship to the development of adult disease and to transgenerational effects (health effects that occur in the child or subsequent offspring of the person who is exposed to an environmental toxin)
3. The health effects of low level exposures to environmental toxicants such as dioxins, endocrine disruptors and lead
4. The health effects of cumulative and multiple exposures to environmental hazards
5. The behavioral outcomes that result from environmental damage to the nervous system
6. The effects on the immune and reproductive systems and the resultant disease outcomes

Recommendations

- Estimation of environmentally-related disease burden in children in the country
- Due to their unique susceptibilities, children should be considered in all risk-assessment and standard-setting procedures to protect them from environmental health hazards
- Strict enforcement of laws related to child labour
- Awareness and education of parents especially mothers about hygiene and sanitation and other environmental health hazards
- Environmental education in schools

CHAPTER – 4

ENVIRONMENT AND HEALTH MANAGEMENT

4. ENVIRONMENT AND HEALTH MANAGEMENT*

Introduction

Environmental management is the process which, by taking into account the overall ecological, cultural, economic, social, technological and other factors, attempts to ensure that the human environment is developed in an integrated and systematic manner. It aims at the best use of the existing and potential resource base in such a way as to maintain, for now and in the long term, the best possible sustained yield from the biosphere. Its ultimate objective is to provide grater personal and social opportunities and to improve overall human well-being for present as well as future generations.

Environmental health management is a relatively new concept, which has evolved partly in response to the problems of haphazard and unbalanced economic development and in particular of the pollution and health hazards, which has resulted from excessive industrialization and urbanization.

Lack of such amenities as clean drinking water, poor housing sanitation, improper disposal of solid and industrial wastes, pollution due to toxic chemicals, contamination of soil, etc, are the most important problems of a developing country like India. The costs associated with these can be very high, which can lead to problems of environmental health management. Appropriate interventions and preventive measures including proper engineering control technology may improve upon the health of the people at large.

Environmental Health is an inter-disciplinary and inter-agency subject. The working group should review the programmes and targets of the 9th Plan and unmet needs in the context of the current state of environment of the country and then formulate a plan of action for the 10th Plan and prioritize the same.

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* Prof. K. J. Nath, Director Professor, AIIH&PH, Kolkata, Dr. P.K. Seth, Director, ITRC, Lucknow, Dr. H.N. Saiyed, Director, NIOH, Ahmedabad, Dr. M. Hota, Joint Director, MoEF, New Delhi and Dr. G.K. Pande, Advisor, MoEF.

Health Impact Assessment

In the recent years, increased attention has been given to estimate the potential health risk involved in industrial or agricultural development projects, both before implementation and during operation. Environmental Impact Assessment (Predictive Analysis) and Environmental Audit (analysis of existing situation) have become necessary now in India. The health components of this activity, is one of the important applications of risk assessment. Such assessment is also used to predict potential health problems in the use of new chemicals or technologies. The term risk assess the health risk, following exposures to toxic chemicals and to minimize the health risk in general, as follows:

(1) Hazard identification:

The first step is to identify the environmental hazard that may be created by the technology or chemicals under study. For this purpose, all the available epidemiological data, toxicity data as well as laboratory data from animal studies need to be critically evaluated to establish cause-effect relationship.

(2) Exposure assessment

This step deals with the possible sources of exposure, the routes of entry of toxins into the body and the target organ/tissues involved. The human exposure assessment should take into account environmental monitoring, biological monitoring and exposure monitoring.

(3) Dose-response evaluation

A quantitative relationship between the dose (amount) of the chemical and the response that is produced in the biological system is estimated. The dose-response relationships can be either linear or non-linear. The dose-response evaluation is useful to establish the regulatory limits.

(4) Risk characterization

As a final step, the exposure data for subgroups of the exposure population are combined with the dose-response relationships for each hazard to calculate the likely health risk in that population, which is known as risk characterization.

Public health officials may act as either risk assessors or as risk managers, and multidisciplinary and interagency involvement is customary, even during minor chemical accidents. A large-scale accident analysis, however, involve physicians, toxicologists, epidemiologists, emergency responders, and other staff from local, state and federal agencies.

Available Database

During the last decade, the Ministry of Environment & Forests, Govt. of India has done commendable work for the assessment of state of environment. An inventory of water pollution load has been prepared through a network of 480 stations covering 14 major, 12 medium, 9 minor river basin, 16 small rivers, 35 lakes & 25 ground water sites. A total of 290 natural ambient air quality stations covering 90 cities & towns across 24 states & 4 union territories, monitor and assess the ambient air quality. An inventorization of waste water in 23 cities have been made. Twenty-four critically polluted areas have been identified and action plan drawn. Pollutional loads from vehicles are being estimated in major cities at regular intervals. Specific action plan to phase out lead in petrol and catalytic converter-fitted vehicles, and tighter emission norms for new vehicles in the country have been introduced. Out of a total number of 1551 units belonging to 17 categories of highly polluting industries, 1269 units had already installed adequate pollution control facilities to comply with the prescribed standards. While 135 units have been closed, remaining 147 are in the process of installing the requisite pollution control facilities. Actions have been initiated with regard to municipal and industrial solid waste management, bio-medical waste, noise pollution control, etc. Preliminary

actions have also been taken on starting environmental epidemiological studies in some of the critically polluted areas to assess the impact of environmental pollution on community health. While primary data in respect of quality of environment and levels of environmental pollution is presently available with the Central Pollution Control Board and various State Pollution Control Boards, epidemiological data in respect of environmentally provoked communicable diseases are inadequate and the same in respect of environmentally provoked non-communicable diseases like cardio-vascular diseases, cancer, etc are extremely poor.

Action Plan

The action plan sees four main activities as key to improving the environmental health policies of the Department of Health/Environment & Forests. These relate to the fundamentals.

- Improving information systems
- Strengthening the institutional structure of Ministry of Health & Family Welfare (MoH&FW) and Ministry of Environment and Forests (MoE&F) to guide policy
- Improving skills and orientation towards environmental health
- Strengthening co-ordination mechanisms.

Improving Information Systems

- Development of a programme of priority epidemiological research on environmental health impacts in the country related to air, water, soil, shelter and ecology, in order to create basic understanding of priority problems.
- Development of a systematic database on the distribution (spatial, social, demographic) of preventable environment-related diseases of major public health significance, in order to prioritize environmental interventions to areas and groups in greatest need.

- Development of a systematic database on trends in environmental health problems in order to monitor and guide long and short term development decisions.

- Development of routine environmental health monitoring systems, initially through pilot linkage between environment and health data sets in order to assess regularly and improve the quality of existing data sets for estimation of environmental health impacts.

Strengthening the institutional structure of MoH&FW and MoE&F

- **Development of a core team on environmental health within the Ministry of Health & Family Welfare and Ministry of Environment & Forests**: It is strongly suggested that a "Environmental Health Cell" be made including team members with skills in environmental epidemiology; environmental management, environmental health policy; who will develop inter and intra departmental skills and will interact with other agencies. Initially, it should be started with a review and situational analysis of current institutional capacity of the MoH&FW and MoE&F.

- **Creation of a National Institute of Environmental Health Sciences at the National level under the MoH&FW and MoE&F with reasonable regional centers**: These activities should start with the help of the existing related institutions designating them as the centers of excellence.

- **Development of legislation related to environment and health:** Initially it should begin with a systematic review of existing legislation related to environmental health and possibly leading to development of linked environmental monitoring and health protection legislation.

- **Development of public awareness programmes**: It should be carried out through improved understanding of risk perception and

development of risk communication strategies. The component aims t promote a systematic approach for generating public awareness throug an Information Education and Communication (IEC) programme o environmental health. The goal of this IEC programme will essentially b to prevent environmental degradation and promote eco-friendly publi behaviour.

Improving skills and orientation towards environmental health

- Programme of in-service training/awareness raising on environmenta health priorities and policy for multiple audiences (Environmental/industria engineers, scientists, medical officers, panchayat leaders, NGOs, CBOs) should be developed.

- Educational curricula related to environmental health monitoring and management should be reviewed and strengthened (e.g. in medicine, public health engineering and urban planning) at the colleges particularly in the engineering colleges and medical colleges.

- Develop programme of training in environmental epidemiology and environmental health policy in order to build core of expertise in environmental epidemiology and policy within the state.

Strengthening coordination mechanisms

To strengthen coordination mechanisms inter and intra-sectoral collaboration is necessary. These would help for the development of:

- environment and health monitoring and action projects, initially through pilot projects in order to guide joint decision-making processes (i.e. water and sanitation and PHC at Panchayat level and air pollution and respiratory health impact at state level).

- opportunities for convergence between environment and health initiatives within the state, specifically beginning with a systematic institutional review of inter institution and programme collaborative processes.

Development of Legislation

There is a need to develop a new law, or amend the existing laws, to introduce provisions for preventing and controlling health problems due to environmental pollution. The environmental health legislation should prioritize objectives for meeting health needs and protecting vulnerable groups without degradation of environment. The environmental health law may include the following health components at local, state and central levels.

- Linking environmental data to possible health hazards (environmental health indicators).

- Controlling environmental health problems through provision for regular epidemiological surveillance and monitoring of hazardous factors by qualified environmental epidemiologists or engineers and scientists.

- Environmental impact assessment regulations may be modified so that a "health impact assessment" is required for all major development projects, including water resource management, urban and rural developments, etc. before such projects are implemented.

Review and Development of Inter-institutional Co-ordination

As collaboration, co-ordination, data linkage and information sharing processes are almost absent among development and health agencies, there is a need to develop inter-institutional co-ordination.

Two examples of inter-institutional co-ordination have been presented. The example shows that at village level, diarrhoeal diseases could be controlled by undertaking water quality monitoring and surveillance programme through the Panchayat and carrying out parallel disease surveillance through the MoE&F and Department of Health. Such co-ordination would provide improved water supply and sanitation and primary health care. Similarly, in urban areas, co-ordination between the DOE/MoE&F and PCB could help to target air pollution controls, resulting in reduction of respiratory diseases and malignancies.

Recommendations

- National Institute of Environmental Health Sciences with Regional Centres should be established.
- Environmental Health Cell should be created in MoH&FW and MoE&F.
- Educational curricula in Environmental Health and Management should be reviewed and initiated in engineering and medical colleges with the help of UGC.
- Public Awareness Programme should be developed through Information, Education and Communication (IEC).
- Existing legislation should be amended and new legislation should be created for preventing and controlling health problems due to environmental pollution.

CHAPTER – 5

RECOMMENDATIONS

5. RECOMMENDATIONS

Environmental and Occupational Health issues are critical because of the enormous impact on health caused by adverse environmental conditions or occupational situations. However, since the matter is inter-sectoral in nature, convergence of activities has been a problem and little has been done in a synergistic manner. Not surprisingly, not much action was also initiated on the recommendations made in this area in the 9th Plan. Therefore, it is necessary to pay attention to the implementation aspects of the recommendations made in this report.

1. CREATION OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH CELLS

Environmental and occupational health cells with multi-disciplinary expertise need to be created in the Ministry of Health & Family Welfare and Ministry of Environment and Forests. There is a need for development of a core team on environmental and occupational health within the Ministry of Health & Family Welfare (MoH&FW), Ministry of Environment & Forests (MoE&F) and Ministry of Labour (MoL). It is strongly suggested that an "Environmental Health Cell" (EHC) be established including team members with skills in environmental epidemiology; environmental management; environmental health policy etc., who will develop inter- and intra-departmental coordination and will interact with other agencies. To start with a review and situational analysis of current institutional capacity of the MoH&FW and MoE&F and MoL should be made.

Nodal Agency : **MoH&FW, MoE&F and MoL**

Budget – **Rs. 1 crore**

2. ESTABLISHMENT OF NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES (NIEHS).

Till now, work related to environmental health issues are carried out by various agencies in the country and there is no apex institute to coordinate their activities. Therefore, there is a need to establish NIEHS in the country.

The objective of NIEHS would be to reduce the burden of human illness and dysfunction from environmental causes by understanding the interactive roles of environmental factors, individual susceptibility and age. The NIEHS will achieve its objective through multidisciplinary biomedical research programmes, prevention and intervention efforts and communication strategies that encompass training, education, technology transfer and community outreach.

This could be done either by establishing an independent Institute or by strengthening the existing Institutes. It is also necessary to have a network of Regional Centres in existing Health Institutions / Medical Colleges / Environmental Health R & D Institutes such as NIOH, Ahmedabad ITRC, Lucknow, COEH (Centre for Occupational and Environmental Health), New Delhi,AIIH&PH, Kolkata, NIMH (National Institute of Miners' Health), Kolar in all major states. The National Institute and its Regional Centres would play a vital role in pursuing environmental health related studies and Human Resources Development Programmes.

Nodal Agency: **MoH&FW and MoE&F.**

Budget – **Rs. 5 crore**

3. RESEARCHABLE ISSUES

The data available on impact of environment on health is very scanty. Appropriate mechanism is not available for establishing linkages between environmental pollution and health impacts. In India, malnutrition, vector-borne and infectious diseases are very common and these can adversely

modify individual response to chemical pollutants. There is a need for co-relating environmental data with morbidity and mortality. The thrust areas for research are as follows:

3.1. Environmental Epidemiology

- **Air pollution:** Indoor air pollution is one of the most widely spread problems in rural India. There are conflicting reports as regard to its relationship with Lung Cancers, Tuberculosis and adverse pregnancy outcome. There is an urgent need to carry out Environmental Epidemiological studies on the health impact of Indoor air pollution, ambient air pollution (with reference to new fuels) and studies in critically polluted areas.
- ***Health Impact of exposure to mixtures of chemicals*** to which most of the people are exposed also need to be investigated.
- **Vulnerable groups:**

Women: A number of factors can modify the environmental health problems of women especially in developing countries like India. The low social status of women, illiteracy, malnutrition, early marriage, multiple pregnancies, and inaccessibility to health services are some of them. Moreover a large number of rural women are exposed to indoor air pollutants generated by biomass fuels. There is a need to study the impact of the above factors on women's health.

Children: The vulnerability of children to acute, sub-acute and chronic effects of chemicals present in the micro and macro-environments demands urgent evaluation and action. In India the health impact of toxic exposures is magnified by the unsafe use of chemicals accompanied by malnutrition and infections, lack of awareness about chemical risks and the effects of pollutants.

3.2 Environmental toxicology:

The extent of air, water, food and soil pollution due to pesticides, heavy metals (Pb, Hg etc.), benzene, dioxins and other endocrine disrupters, has not been evaluated in the country. National surveys should be undertaken to assess the effect of exposure to these pollutants through air, water and food.

3.3. Development of Bio-markers: The health impact of chemical exposure is a chronic process and the development of specific diseases due to continued exposure, takes long time. When such effects are detected clinically, the damage is usually severe and irreversible. Therefore, there is a need to develop biomarkers of the exposure and effect at pre-clinical level. Moreover, there is a small set of population, which is genetically susceptible to toxic effects of certain chemicals. It is possible to identify such susceptible individuals. **"Environmental genomics"** is a branch of genetics, which seeks to elucidate individual variation in response to the environmental toxicants. *There is an urgent need to develop bio-markers of exposure, effect and susceptibility in our country.*

Nodal Agency : ICMR & CSIR

Budget – Rs. 15 crore.

4.. ADVANCED RESEARCH FACILITIES

Development of National facility for the analysis of toxic substances at nano gram level: The facilities for analysis of pollutants at very low concentrations existing in various national laboratories should be strengthened so as to make them National Reference Laboratories. These laboratories may also supervise the quality control in analysis and issue accreditation certificates.

Nodal Agency: ICMR, CSIR, DBT. (Dept. of Biotechnology)

Budget: Rs. 10 Crores

5.. HUMAN RESOURCES DEVELOPMENT

The officers of the Central Pollution Control Board and also the Pollution Control Boards of State Govts and other officers dealing with environment and health related issues like Medical Officers, Public Health Engineers, Hygienists etc. need to be imparted training and orientation courses in the related field. This programme should be need-based and conducted by the institutes like NIOH, NEERI, ITRC, AIIH&PH, COEH and DGFASLI. The University Departments may also provide faculties for such programmes. The Central Co-ordination Committee, consisting of representatives of these Institutes, may develop training modules for these programmes. The ESI scheme has a large medical infrastructure spread through out the country with occupational disease centers in four metropolitans cities. The doctors associated with ESI scheme need to be imparted training in the diagnosis of occupational diseases. This programme should be a part of in-house training programme and also be a part of medical curriculum. There is also a need for in-service training of other concerned personnel.

Nodal Avency: MoH&FW, MoL & ICMR

Budget – Rs. 3 crore.

6. REVIEW OF EXISTING CURRICULA AND DEVELOPMENT OF ENVIRONMENTAL AND OCCUPATIONAL MEDICINE CURRICULA

6.1. Environmental and occupational medicine: This should be developed and introduced in medical colleges.

6.2. Review of environment related curricula: There is a need to review and update curricula related to environmental pollution and management in science and engineering faculties.

Nodal Agency: UGC, Medical Council of India

Budget: Rs. 1.00 crore

7.. PUBLIC AWARENESS PROGRAMMES:

This component aims to promote a systematic approach for generating public awareness through an Information, Education and Communication (IEC)

programme on environmental health. The goal of this IEC programme will be essentially to prevent environmental degradation and promote eco-friendly human behaviour.

Nodal Agency : MoH&FW & ICMR

Budget: Rs. 2 Crore

8. DEVELOPMENT OF DATABASE AND INFORMATION SYSTEM IN ENVIRONMENTAL AND OCCUPATIONAL HEALTH

Several International Conferences held in India and abroad have emphasized that database on Environmental & Occupational Health at National level is not available in India. The first requirement, however, is to collect data and information on research already conducted. The initiatives should be:

a) Making a Directory of the Government Institutions and Universities/Departments working on Occupational and Environmental related matters and linkages between them. Information can also be collected on the capabilities of these institutions for doing various types of activities.

b) Compilation of available information regarding epidemiological surveys and related studies to prepare a National Environment and Occupational Health profile.

A National Environmental & Occupational Health profile is urgently needed to be developed so as to prepare a National Environmental Health Action Plan. This would require more environmental epidemiology studies and investigations in following areas:

- Critically polluted / heavily polluted areas.
- Specific pollutants (e.g. lead, arsenic, benzene, particulate matters).
- Water Pollution.
- Air Pollution (including vehicular pollution).
- Environmental Toxins.
- Indoor Pollution.
- Industrial accidents.

- Urban planning and waste (municipal, medical and hazardous) disposal.

Nodal Agency : **MoH&FW , MOE&F and ICMR**

Budget: Rs. 2 crore

9. **URBAN WATER QUALITY MONITORING AND HEALTH SURVEILLANCE**

This could not be initiated during the 9th plan period. This should be considered during the 10th five-year plan.

Nodal Agency : **MoH&FW**

Budget: **Rs. 2 crore**

10. **RURAL WATER QUALITY MONITORING AND HEALTH SURVEILLANCE:**

This programme started promisingly and in the 1st two years, pilot project was implemented in the states of Kerala, Karnataka, U.P., Gujarat, Haryana, Rajasthan but in the subsequent years very little work was done to sustain the programme because of lack of administrative support. Water quality monitoring, both at urban and rural areas can be carried out with the help of NICED at Kolkata.

During 1999 / 2000 programme was not implemented in any state. Implementing community based programmes, with the help of NGOs, should be considered.

Nodal Agency : **MoH&FW, Ministry of Rural Development**

Budget: **Rs. 3 Crore**

11. **SOLID WASTE MANAGEMENT INCLUDING HOSPITAL AND HAZARDOUS WASTE**

There is a need for safe methods of collection, transportation and cost effective methods for disposal of solid waste. For the management of hospital waste activities undertaken by the health sector at the state government as well as central level for training and capacity building had been inadequate and need to be strengthened.

Nodal Agency : **MoH&FW & MoE&F**

12. STRENGTHENING AND ESTABLISHMENT OF POISON INFORMATION CENTRES:

Poison information centres play an important role in reducing mortality and morbidity from toxic exposures. During the 10th five year plan, it is proposed to start at least six centres of excellence which can offer teaching and training in clinical toxicology and help in creating other centres in the country.

Nodal Agency : MoH&FW and MoE&F

Budget: Rs. 12 Crore

13. PREVENTION AND CONTROL OF OCCUPATIONAL DISEASES:

a) **Identification of thrust area (Data generation)**

It is recommended that a core group of technical experts may be constituted who can identify various important Occupational Hazards so as to reduce their health impacts with or without the use of control technology.

Nodal Agency: MoH&FW, MoL.

b) **Elimination/Control of hazards through engineering control**

This would help development of appropriate technology for hazardous jobs particularly in the informal sector of industry.

Nodal Agency: MoL and MOE&F

c) **Optimum enforcement of Legislation (Strengthening of Inspecting Laboratories)**

1. Development of manpower: Training of Factory Inspectors, Medical Inspectors and Laboratory Staff, etc.
2. Development/Strengthening of infrastructure facilities in industrial hygiene laboratories of the State Governments and DGMS for work environment sampling.

Nodal Agency: MoL

d) Appropriate diagnosis and management of occupational diseases

1. Training of industrial medical officers, ESIS medical officers, doctors working in PHCs and District Hospitals.
2. Strengthening of laboratory and diagnostic facilities

Nodal Agency: MoH&FW.

e) Creation of awareness among workers, trade unions and management

Training and Education.

Nodal Agency: MoH&FW, MoL.

Budget : Rs. 25 Crore.

13. .DEVELOPMENT OF LEGISLATION

There is a need to develop a new law, or amend the existing laws, to introduce provisions for preventing and controlling health problems due to environmental pollution. The environmental health legislation should prioritize objectives for meeting health needs and protecting vulnerable groups without degradation of environment.

Nodal Agency : MoE&F, MoH&FW, Min. of Law.

CHAPTER – 6

BUDGET

6. BUDGET REQUIREMENT

An approximate budget requirement is indicated below for various activities, which need to be undertaken by the organizations under the Ministry of Health & Family Welfare, Govt. of India. These activities include priority action programmes under 5.0, as well as 'unmet needs' as under:

Sl. No.	Activities	Nodal Agency	Implementing Agency	Budget Requirement (Rs.In crores)
1.	Creation of environmental and occupational health cell in the Ministry of Health & Family Welfare, Govt. of India and a similar cell in MoEF	MoH&FW, MOEF, Min.of Labour (MoL)	ICMR	10
2.	Establishment of a National Institute of Environmental with Regional Centres in all major states	MoH&FW, MoEF	ICMR/CSIR	200
3.	Researchable issues	ICMR & CSIR	NIOH, NICD, ITRC, NEERI, AIIH&PH	50
4.	Advanced Research Facilities	ICMR, CSIR, DBT	AIIH&PH, NIOH, ITRC, NEERI, NICD, DGFASLI	50
5.	Human Resource Development	MoH&FW ICMR	AIIH&PH, NIOH, ITRC, NEERI, NICD, DGFASLI	10
6.	Review of existing curricula and development of new environmental and occupational health curricula	University Grants Commission (UGC), Medical Council of India and Universities, MoH&FE, ICMR	University Grants Commission (UGC), Medical Council of India and Universities	2
7.	Development of database and information system in environmental and occupational health	ICMR MoH&FW	ICMR/CSIR institutes	20
8.	Urban water quality monitoring and health surveillance: Capacity building in the local bodies	MoH&FW	AIIH&PH, NEERI, NICD, ITRC and NIECD	5

Sl. No.	Activities	Nodal Agency	Implementing Agency	Budget Requiremer (Rs.In crores)
9.	Hospital solid waste management and Hazardous Waste Management Capacity building in the public sector health establishments and Municipalities	MoH&FW, MoE&F	a. Health Dept. of State Govts/ Union territory b.DGHS Medical Institutes c.CSIR/ICMR Institutes	100
10.	Rural water quality monitoring and health surveillance: evaluation of the 9th plan pilot studies and implementation of community based rural water quality surveillance in the rural areas of the entire country	MoH&FW Ministry of Rural Development	Dept. of Rural Development	100
11.	Strengthening and establishment of Poison Information Centres	MoH&FW	NIOH-BJMC, Ahmedabad PGI, Chandigarh ITRC-SGPGI, Lucknow KEM Hospital-Mumbai GGH- Chennai AIIMS- New Delhi	12
12.	Prevention and control of occupational diseases (agriculture, unorganized and organized sectors)	MoH&FW, MoL	ICMR, NIOH, DGFASLI, ITRC, AIIH&PH, DGMS and National Institute of Miners' Health (NIMH)	100
13.	Indoor Air Pollution	MoHF, Min.of Information & Broadcasting Min. of Rural Development	MoHF MoE&F	100
14.	Development of Legislation	MoEF, MoH&FW, Min. of Law & Justice	MoEF MoH&FW Min. of Law & Justice	-

CHAPTER – 7

ANNEXES

Annexure-1

LIST OF MEMBERS
(identified by Planning Commission)

1.	**Prof. N.K. Ganguly** Director-General Indian Council of Medical Research Ansari Nagar New Delhi-29	**Chairman**
2.	Secretary* Ministry of Labour Shram Shakti Bhavan New Delhi	Member
3.	Secretary* Ministry of Environment & Forest Paryavaran Bhavan CGO Complex Lodi Road New Delhi	Member
4.	Chairman Central Pollution Control Board Parivesh Bhavan East Arjun Nagar Shahdara Delhi –51	Member
5.	Director Centre for Science & Environment New Delhi	Member
6.	Medical Commissioner, Employees State Insurance Corporation ESIC Building, Temple Lane, Kotla Road, New Delhi –2	Member
7.	Director National Institute of Occupational Health Meghani Nagar Ahmedabad – 380 016	Member

8.	Director General FASLI Eastern Express Highway Mankiker Marg Sion; Bombay –400022	Member
9.	Dr. A.D. Bhide Deputy Director NEERI Nagpur	Member
10.	Dr. K.J. Nath Former Director All India Inst.of Hygiene & Public Health, 110, Chittaranjan Avenue, Calcutta	Member
11.	Ms. Indu Capoor CHETNA Ahmedabad Gujarat	Member
12.	Representative Health & Family Welfare Division Planning Commission New Delhi – 1	Member
13.	Dr. Lalitha Kameswaran 5, Third Avenue, Indira Nagar, Adyar, Chennai - 600020	Member
14.	Advisor/Director Environment, Forests and Tourism Unit, Planning Commission, New Delhi	Member
15.	**Mr. Deepak Gupta** Joint Secretary Department of Health Ministry of Health & Family Welfare Nirman Bhavan New Delhi – 11	**Member – Secretary**

(* In case members can not attend for unavoidable reasons, they may depute their Nominee)

Annexure-2

MINUTES OF THE FIRST MEETING

Minutes of the Joint Meeting of the Working Group on Environment and Occupational Health on 21st Feb 2001 at 10.00 A.M at ICMR Headquarters, New Delhi.

The Director General, ICMR called a meeting of the working group constituted by the Planning Commission to discuss the multiple issues pertaining to environmental and occupational health and to formulate subgroups, each of which could look into the specific aspects associated with environmental and occupational health issues. Following members were present.

Prof. N. K. Ganguly (Chairman)
Prof J. N. Pandey
Shri S. K. Saxena
Dr. T.V. Ranga Rao
Dr. V. N. Sardana
Dr. Mrs. S. Singh
Dr. A.K. Khokhar
Dr. S. D. Sharma
Dr. H. C. Joshi
Dr. Jugal Kishore
Dr. K. Balaram
Dr. P. G. Sengupta
Dr. Bela Shah
Dr. H. N. Saiyed
Dr. S. K. Bhattacharya
Dr. D. J. Parikh
Dr. R. S. Dhaliwal
Dr. Tripti Khanna

Prof N. K. Ganguly welcomed the members and appreciated their presence inspite of holiday. While briefing on modalities for subgroups and draft paper preparation, Dr. Bela Shah informed that the Planning Commission has constituted working groups to prepare comprehensive document on environmental and occupational health for Xth five year plan. She informed that eleven working sub groups each consisting of a chair person, main

resource person and expert were tentatively formed to look into various specific areas. She elucidated the terms of reference of the Committee and the Sub groups.

Prof N. K. Ganguli, in his introductory remarks said that occupational and environmental health related issues are very important for existence of the present and future generation of mankind. He advised members to go through the IXth five year plan document and asked Dr. Bela Shah to circulate the copy of the same. He suggested a format for the preparation of the document by each subgroup (Given in Tabular form).

Document prepared by each subgroup should be supplemented by an executive summary, charts, tables, figures etc. in easily intelligible format.

Prof. J. N. Pandey said that unsafe water supply and lack of sanitary waste disposal are two major environmental health related issues in the country. He suggested that radiation hazard and hospital waste disposal are other areas of concern. DG suggested Dr. Rath of Cancer Research Centre could be co-opted member.

Shri S. K. Saxena opined that ergonomics, stress related issues and IT sector need to be given priority. He informed that DG FASLI is operating web site related occupational safety and health. Dr. Rao emphasized the need of development of trained manpower through short term and advanced training modules in occupational and environmental health programmes.

Prof. Ganguli suggested that occupational health problems of cycle rickshaw pullers, high nicotine exposure in green tobacco workers and hypertension in salt workers and tea plantation workers are lesser known but important occupational health problems which needs to be investigated for suitable intervention devices.

Dr. V. N. Sardana suggested that the report of a recent committee appointed by MoEF for environmental health should be utilized for preparing the document. He also suggested that a member from this committee and NAMP could be co-opted. The DG informed that Secretary, MoEF is already the member of the Committee.

Dr. (Mrs.) S. Singh informed that out of 300 million working population, only 9 million workers are covered under the ESI Act. She suggested that liberalizing terms and conditions for health insurance can lead to provide coverage of many more hitherto uncovered workers of organized and unorganized sector of industry. She agreed to provide a write up on modalities of the same.

Dr. S.D. Sharma informed that the urbanization is the most important issue of occupational and environmental health. If we take WHO criteria then 95% people lives in slums in New Delhi. He suggested that the causes of drift of the people from rural to urban areas should be investigated. He also drew attention to the effects of media particularly television on life style of people. He suggested a mechanism to curb misinformation by the media, as the same can be a powerful source in protecting the environment.

Dr. H.C. Joshi briefly mentioned about the problems related to pesticide residues, occupational health problems of the farm workers, generation of green house gases like methane and nitrous oxides by plants particularly rice and polluted ground water used for irrigation. He also mentioned about recycling of agricultural waste. The Chairman agreed that environmental pollution and water pollution are two important areas. There should be a national program on water management. He also emphasized to make distinction between microbiological and chemical contamination of the water.

Dr.Jugal Kishore mentioned about the urbanization and creation of environmental health center. Dr. Balram said that VCRC could prepare a document on Vector borne diseases.

Dr. Sengupta said that the database available at NICED could be compiled for river and marine pollution for the document.

Dr.D.J. Parikh mentioned about solid waste management from the hospital and industrial waste management. He also emphasized the need for auditing of environmental health related issues.

Dr. S. K. Bhattacharya said that noise is the most important environmental pollutant particularly in the urban areas and factory environment. He emphasized the need of introducing audiometry in pre-placement and periodic medical examination of the high risk workers. He also suggested mass awareness programme highlighting adverse health effects due to noise pollution. Further he said that all the State Govts. should follow the example of West Bengal Govt. in making lawful control of noise pollution. The Chairman agreed with the proposal.

Dr.H.N. Saiyed said that environment is a broad term and includes everything under the sky. Even the genetic factors are the outcome of mutation and other mechanisms of evolution. He proposed that the scope of environmental factors should be limited to physical, chemical and biological agents. Dr. Saiyed suggested that a sub-group on occupational health should also be formulated. He agreed to co-ordinate the activities of this group. The Chairman agreed with the suggestion.

The Chairman appointed Dr.H.N. Saiyed, Director, NIOH and Dr.Bela Shah, Chief NCD, ICMR, to coordinate the activities of the sub-groups. He also suggested that any sub-group could call the local meeting to prepare the draft. The expenditure on account of TA/DA and the Secretarial Assistance could be reimbursed by the council.

It was also decided that the draft report by the sub-group would be prepared and presented during the next meeting of the sub-groups on 14th March 2001 at ICMR HQ.

The meeting ended with a vote of thanks.

Format for Preparation of Document

Preamble	Identification of the Problem
Data Base	Collection, collation and convergence of the available data.
9th Five Year Plan	Examine programme and achievements.
10th Five Year Plan	Suggested Programmes and Activities New Emerging Issues e.g. global warming, disasters (draughts, floods, earth quakes), biotechnology and environment, increased international travel, newer bio-pesticides, indoor air pollution. Researchable Issues
Resources	Needed; Suggested resource flow.
Inter-sectoral Involvement	List agencies, suggest mechanism.
List of existing regulations	Suggest effective mechanism of implementation.

Annexure-3

Minutes of the 2nd Meeting of the Xth Five Year Plan Working Group on Environmental and Occupational Health on 20th March, 2001 at ICMR Headquarters, New Delhi

The Director General ICMR called the 2nd meeting of the working group to review the progress made on the multiple issues pertaining to environmental and occupational health. Following members were present:

Prof. N.K. Ganguly (Chairman)
Dr. J.N. Pande
Dr. S.K. Saxena
Dr. P.K. Seth
Dr. K.J. Nath
Dr. A.K. Khokhar
Dr.T.V.Rango Rao
Dr. H.C. Joshi
Dr. A.D. Bhide
Dr. Shelley Bhattacharya
Dr. Sudhir Chandra
Mr. K.K. Marwaha
Dr. Jugal Kishore
Dr. R.C. Dhiman
Dr. K. Balraman
Dr. P.G. Sen Gupta
Dr. Bela Shah
Dr. H.N. Saiyed
Dr. S.K. Bhattacharya
Dr. D.J. Parikh
Dr. A. Dewan
Dr. R.S. Dhaliwal

Dr. Bela Shah welcomed the members and appraised the proceedings of the first meeting held on 19th February at ICMR HQ, New Delhi. She mentioned that the copies of the 9th Five year plan pertaining to environment and health along with the format for the preparation of the documents were circulated. She also presented the list of the documents to be prepared and the names of the resource persons. She pointed out that financial aspects have not been covered so far in the documents received.

Prof. N. K. Ganguly stressed that there should be critical appraisal of the 9th plan document to see the goals which have been met and unmet. He suggested that for the 10th plan document, in each chapter there is a need to identify one or two major issues and these should be put in boxes. Commenting on the financial aspects, he said that the programme could be carried out depending on the availability of the budget. He suggested not to give arbitrary financial figures but categorize under different heads: (e.g. the goals which could be met if 100% budget is available and the goals which could be met with 85% or 75% of funds.). Prof K.J. Nath pointed out that the institutional issues need to be addressed. Prof Ganguly suggested that in the 10th Five-year plan document following issues need to be covered adequately:

- Institutional strengthening and capacity building.
- Environmental epidemiology.
- Interaction of genes with the environment and,
- Information network on the environment.

He then suggested following timetable for the preparation of the document.

- Committee at NIOH under Dr. H. N. Saiyed to prepare "Zero Draft" from the documents received from resource persons. The resource persons were requested to send the revised version of their document by e-mail and a printed copy by post/courier on or before 31st March 2001.

- Committee consisting of Prof K.J. Nath, Dr. P. K. Seth and Dr. H. N. Saiyed to prepare "zero plus draft" by 15th April 2001.

- "Zero plus draft" to be discussed in the third meeting of the group and the final document to be prepared by 30th April 2001.

Prof. K.J.Nath, informed that he was member secretary for the group who prepared the document of Environment and Health for the 9th Five year plan, and mentioned that most of the recommendations in the plan were not implemented. Prof Nath also informed that a National Taskforce on environmental health has also been constituted by the MOEF, and a number of recommendations may overlap, as each ministry will have its own plan. Prof. Ganguly suggested that the recommendation of the present group should be limited to the health related environmental issues. He also requested Prof. Nath to prepare a chapter on Environment and health management and send it to Dr. Saiyed by 31st March. Prof. Nath agreed

Dr. Shelley Bhattacharya remarked that in this group, she was the only representative from university and a lot of work is being carried out in various universities on environment related issues. However, by and large the scientists are not aware of this. At this juncture, Prof. Ganguly emphasized the need of networking of various institutions in the country.

Prof. J.N. Pande expressed his inability to prepare the draft document on Hospital medical waste, as this was not his field of work. Instead, he gave a presentation on Outdoor air pollution. He pointed out that the data on important pollutants like ozone are missing. He also requested Chairman to make sure that a representative of Central Pollution Control Board is involved. It was also suggested that there should be time series approach to correlate mortality and morbidity in hospitals with air pollution levels. Prof. Ganguly stressed that biomarkers for early exposure, effect and susceptibility to individual pollutants should be developed which can be one of researchable issues.

Dr. H. N. Saiyed highlighted the burden of occupational diseases in the country giving detailed information on workers engaged in different industries and high prevalence of occupational diseases and injuries. He brought out the problems with the diagnosis of occupational diseases and the need for

sensitization of different stakeholders. The occupational health problems of self-employed workers who are not covered by any of the existing laws were also discussed. Dr. Aruna Dewan pointed out that majority of our work force belong to the unorganized sector of industry and they are not covered by the provisions of occupational health, safety and welfare.

Dr. P.K. Seth made a brief presentation on occupational and environmental health issues. He opined that environment related health issues of children and women health, neurogenerative disorders, reproductive ailments and genotoxic effects and immune system disorders should be a priority area. He also emphasized that the new test system of health effects of certain pollutants like lead, mercury, arsenic, pesticides, PCBs and benzene should be developed. He also suggested that the methodology for the chemical analysis of various toxicants need to be standardized and a national analytical facility be developed. Finally, he suggested that it is important to emphasize only those issues, which are doable.

Dr. Ranga Rao presented the Indian statistics with reference to workforce employed in industries and highlighted the problems of ergonomics and stress management. He said that in spite of plethora of legislation, the implementation is poor. He stressed the need for increased awareness and education in occupational health of medical personnel. Mr. S. K. Saxena emphasized the need of sensitizing the workers and development of trained manpower. He also suggested that the occupational health of the unorganized sector could be merged with primary health centres.

Dr. Sen Gupta and Prof. Shelley Bhattacharya spoke on the health impact of contamination of drinking water by microbes and chemicals respectively from the sanitary disposal and industrial wastes. Prof. Nath underlined the importance of water quality surveillance. He informed about the successful pilot project on " Community based water quality surveillance during 9^{th} plan. Dr. Bela Shah opined that the improvement in water quality could be achieved

through stringent legislation, enforcement, penalties, compensation and community participation. Prof. Ganguly informed the members about the successful Churu experiment in Rajasthan, where 300 villages paid for potable drinking water and similar attempts can be made in the 10th plan.

Prof. Shelley Bhattacharya expressed great concern about the sources of water supply in the villages where villagers are forced to drink contaminated pond water. Arsenic and fluoride contamination of water is a major problem in certain areas of the country.

Dr. Khokhar highlighted that majority of workforce in the country is in the unorganized self-employed sector. So the mechanism of social security for this group has to be developed. He gave the example of Kerala State, which has 17 labour welfare schemes for the self-employed workers. In these schemes as there is no employer, the Govt. has to make a higher contribution. He also said that a number of agencies such as ESIS, CLI, NIOH etc. are engaged in the field of occupational health. However, the studies are fragmented and there is need for an apex body who can coordinate the work of various organizations.

Dr. Jugal Kishore made a presentation on health issues related to urbanization. He informed that at the present rate of migration, 34% of the population of India will be living in urban areas by 2020. He gave an outline for Safer and Healthy cities programme. Some of the problems related to waste minimization, health problems of child labour and construction workers were also raised.

Dr. Balaraman briefly outlined the existing arrangements for prevention of vector borne diseases and suggested strategies for further preventive measures.

Dr. Joshi highlighted the role of organic farming to reduce the need for chemical fertilizers and pesticides. Use of human waste for manure and brickets from dry leaves for fuel were suggested as alternatives to chemicals. These measures will reduce evolution of green house gases, which lead to global warming.

Dr. Dewan briefly outlined the problem of poisoning in the country and the lack of Poison information centres. Prof. Ganguly stressed the need for one centre in each state of India and few centres, which can work as referral centres. For these centres there is a need for development of infrastructure and research strengthening.

Health hazards due to indoor air pollution, and their high prevalence in India due to use of traditional fuels, were presented by Dr. Saiyed .

In his presentation on noise pollution, Dr. S.K. Bhattacharya highlighted the health problems caused by noise due to industrial processes, transport and building construction, aircrafts, and community sources etc. He also informed that there is no legislation for the control of noise in the country. He cited the example of W. Bengal where loud noise is prohibited between 10 pm –6am. Dr. Jugal Kishore suggested that the effect of TV and Radio noise on the younger generation should also be considered.

Dr. Bhide expressed concern about continuing unhygienic sanitation including open air defecation across the country which can lead to a variety of infections in the handlers as well as in the general population

During the discussion, members suggested that there should be a National Institute of Environmental Health Sciences in the country. This institute can investigate the issues related to environment and health and provide guidelines for prevention. Some members suggested that the existing

institutes working on similar areas can be upgraded or a separate institute can be established.

Dr. Sudhir Chandra informed that in the 9th Five Year Plan, eight projects under the scheme on the National Programme on Prevention and Control of Occupational Diseases have been financed (about Rs.5.00 crore) by the Ministry of Health and Family Welfare.

In the end, Dr. Pande summarized the proceedings and in his remarks he mentioned the following points

- Problems related to environmental health in country are diverse and enormous

- Need of basic research for the solution of unsolved problems.

- There is an urgent need for continuous surveillance and monitoring of all activities at all levels.

- Inter-sectoral boards/committees could be created for effective networking.

- Institutional capabilities need to be strengthened to undertake the aforementioned activities

Prof. Ganguly appreciated the efforts of all the members for preparing the documents well in time. He requested that the members who have not been able to send their documents to Dr. Saiyed may do so by 31st March, 2001. The meeting ended with thanks to the chair and the members.

ADDENDA

Dr. Sudhir Chandra informed that under the scheme of Environmental Health and Risk Assessment, the approved outlay in the year 2000-01 was Rs.1.0 crore, out of which Rs.15.00 lakhs have been approved for the study on "Morphological changes in Rat Brain following continuous pre-natal nicotine exposure", to be conducted by AIIMS and Rs.85.00 lakhs for the study on "Health Risk Assessment of Rural and Urban Population due to indoor ambient air pollution" by national Institute of Occupational Health. It was also mentioned that during current financial year 2001-02 an outlay of Rs.1.0 crore has been approved under environmental health and risk assessment scheme" and Rs.4.50 crores under National Programme for Control and Treatment of Occupational Diseases.

Dr. R.C. Dhiman discussed about the feasibility of Remote sensing in monitoring the ecological changes caused due to urbanization, agricultural practices, floods, deforestation or other environmental changes affecting malaria

Annexure – 4

AREAS IDENTIFIED FOR DRAFT DOCUMENTS FOR THE WORKING GROUP ON ENVIRONMENT AND OCCUPATIONAL HEALTH

Hospital Waste Outdoor air pollution	Prof.J.N. Pande, AIIMS
Safe drinking water Safe sanitary disposal	Dr.Sengupta,NICED/ Dr. K.J. Nath, AIIH&P
Ergonomics in organized industry Stress management in Industry	Mr. S.K. Saxena, DGFASLI
Occupational health in PHCs Env.in medical education	Dr. T.V. Ranga Rao, DGFASLI
Emerging and reemerging infections Health hazards due to environment	Dr. V.N. Sardana, NICD
Radiation hazards	Dr. G.K. Rath, CRC
Social, health security and compensation Industrial pollution	Dr.(Mrs.) Subhash Singh, ESIC
Linkages between different organizations	Dr.A.K. Khokhar, ESIC
Urbanization Health of vulnerable groups-women, children and elderly	Dr. S.D. Sharma, IHBAS
Agrotech and environment River and ocean pollution Pesticides	Dr. H.C. Joshi, IARI
Current policies – Urbanization	Dr. Jugal Kishore, MAMC
Vector borne diseases & insecticides	Dr. K. Balram, VCRC
Solid Waste management	Dr.D.J. Parikh, NIOH
Noise Pollution	Dr. S.K. Bhattacharya, NIOH
Indoor Air Pollution	Dr. H.N. Saiyed, NIOH
Occupational Health Problems	Dr. H.N. Saiyed, NIOH
Poison Information	Dr. A. Dewan, NIOH
Secretarial Assistance	Mrs. Gurmit Gursahani, NIOH